The Electrical Industry's Weekly Magazine

November 26, 1956

Electrical World

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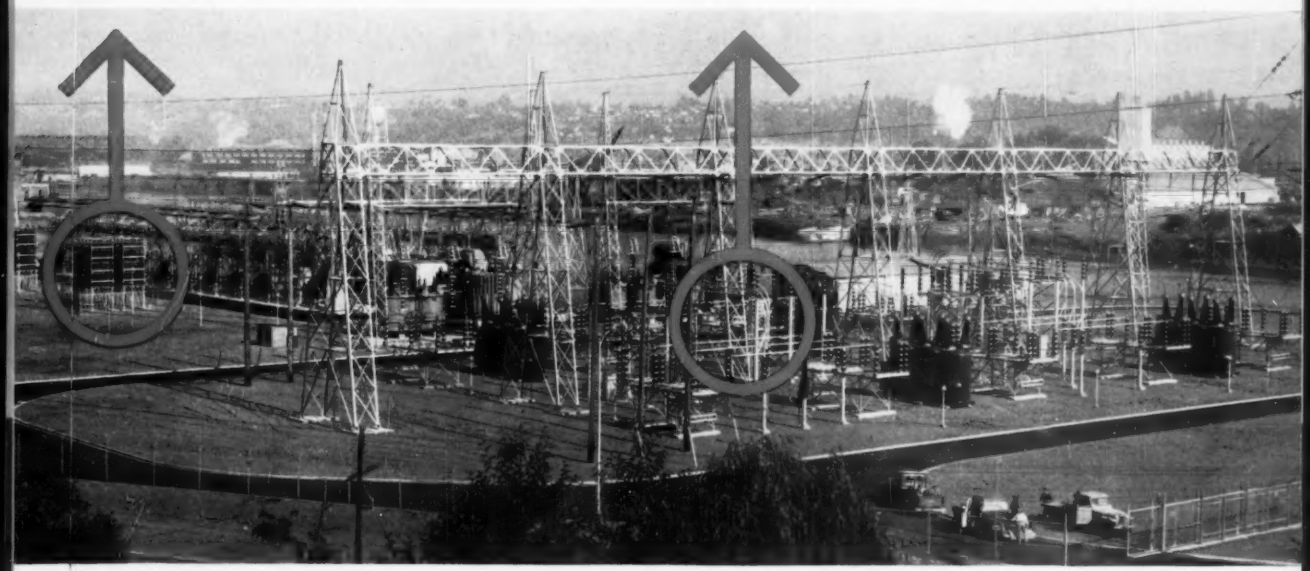
Modern Design Eases



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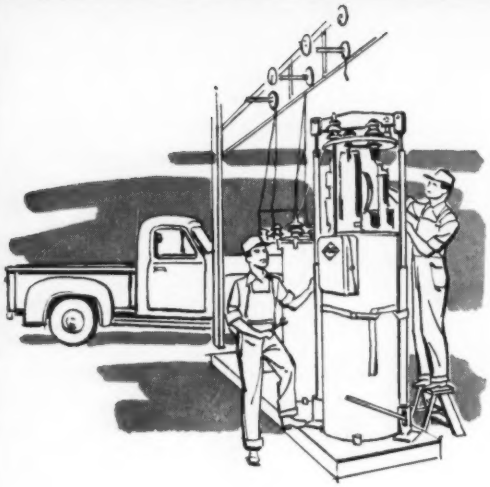
Taking Chance Out of Promotions . . . Page 77

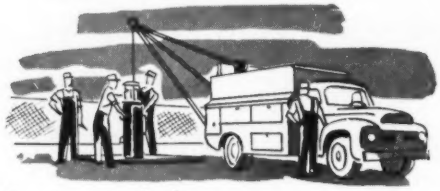
Compare Allis-Chalmers Regulators with Others

Slash Regulator Service Costs 75%



THIS

On-the-spot service with Allis-Chalmers cover-suspended regulators—2-man crew and pickup truck does the job without moving unit.



OR THIS

Other regulators usually require a 4 or 5-man crew and boom truck to move regulator and do piecemeal untanking and retanking.

1—Drain oil from tank

2—Remove cover, bushings and control leads

3—Piecemeal untanking

Eliminates need for moving and piecemeal untanking which costs 4 to 5 times more!

This is the key to savings with Allis-Chalmers regulators! Unit construction makes it possible. A 2-man crew using a pickup truck (not a boom truck) can switch the regulator off the line, set up the portable hydraulic jack and in a few minutes lift the entire regulator mechanism far enough out of the tank for inspection. Only Allis-Chalmers regulators provide full unit construction.

For complete information, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

LIVE BETTER ELECTRICALLY

ALLIS-CHALMERS

A-5139

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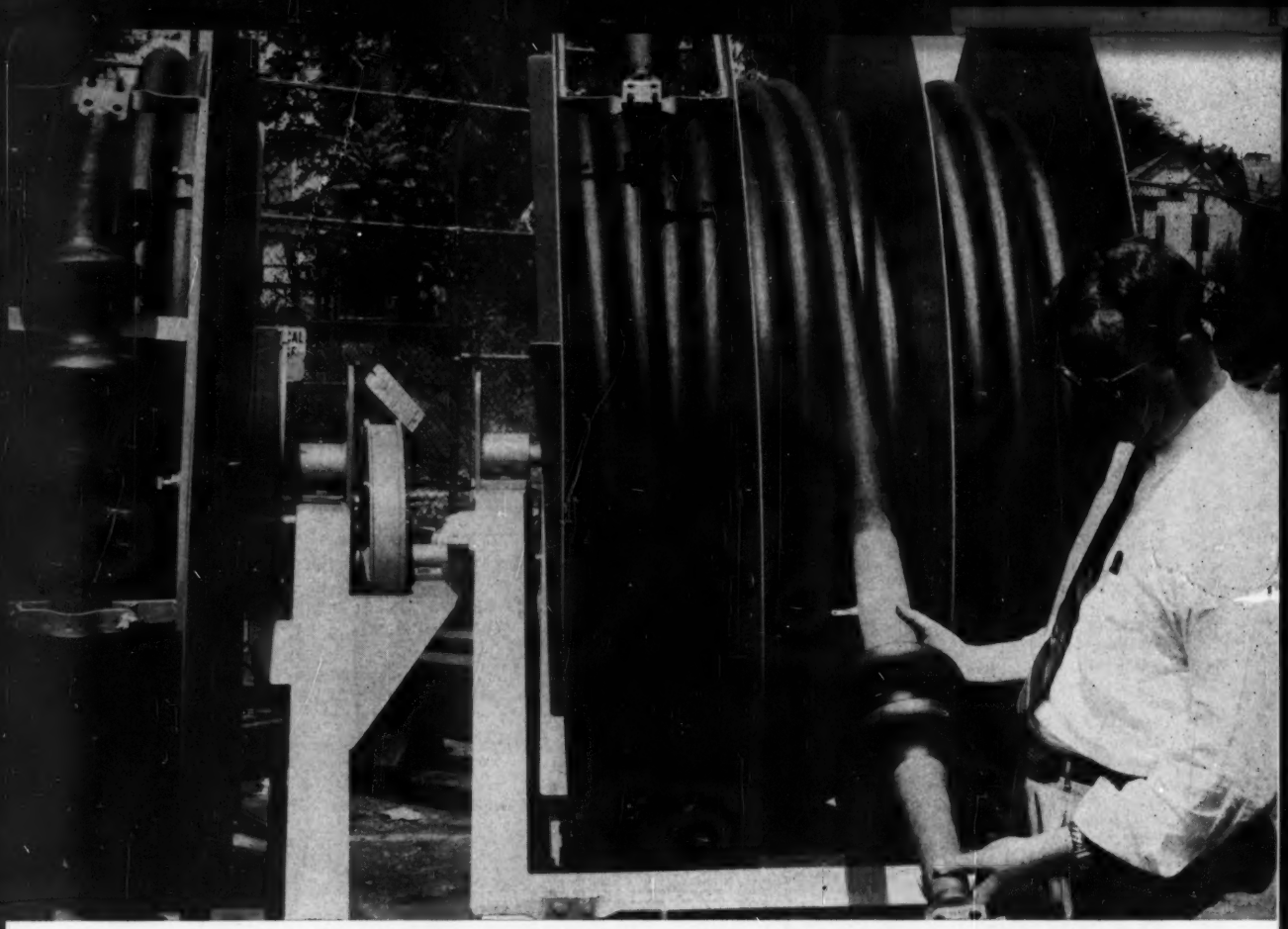


Okonite's portable substation cable showing factory-made terminations (bracket on specially designed reel holds one on left, while engineer examines another at right). Color coded terminations include vulcanized stress relief cones and insulators, ground straps and terminal lugs. They are ready for immediate use.

for substation emergencies or maintenance... use Okonite portable cable

Okonite portable substation cable has two important utility applications:

Emergency service—Cable is used to quickly connect mobile substations into existing lines when regular substation is out of operation. This reduces amount of service loss to consumers.

Maintenance—Portable substation equipped with Okonite cable maintains service to power users while substation is de-energized and serviced.

Advantages of Okonite portable substation cable:

Primary and secondary cables are available with heavy reinforced Okoprene sheath which provides extended service life. Sheath withstands mechanical strain caused by repeated winding, unwinding and dragging over the ground. Moreover, the extra flexible conductor and shielding braid provide easy handling under all weather conditions.

Cables are supplied in specified lengths with factory-made terminations at each end. (Type and style of terminal lug is specified by customer.) With these complete, factory-made terminations, the cable is ready for immediate service and can be connected in a matter of minutes.

Okonite cable can be supplied on specially designed steel reels, with conventional or bifilar wind (the latter enables cable to be unwound in opposite directions simultaneously). They can be immediately mounted on assigned truck and are provided with manual driving gear and brake for let-off and take-up.

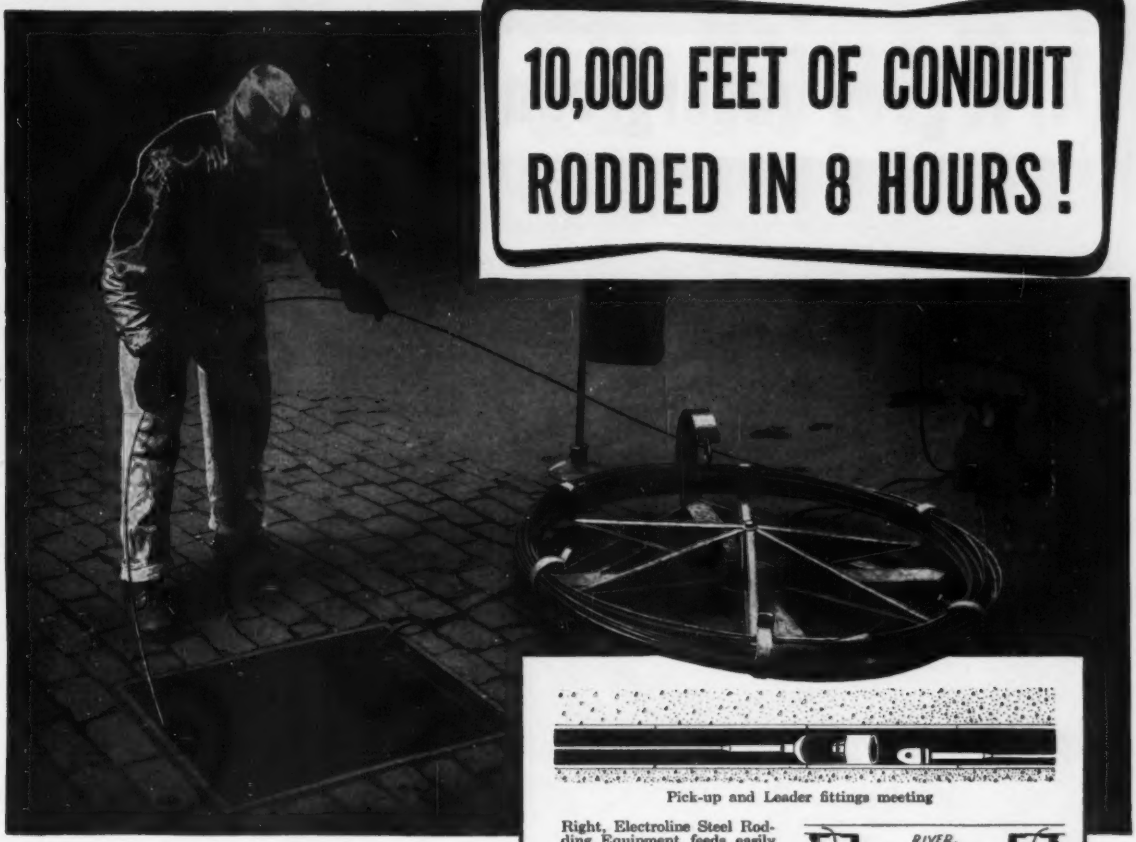
For complete information about Okonite portable substation cable, write to The Okonite Company, Passaic, New Jersey.

available with copper or aluminum conductors

OKONITE OKONITE SINCE 1878 ***insulated cables***

3889

10,000 FEET OF CONDUIT RODDED IN 8 HOURS!



Pick-up and Leader fittings meeting

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.

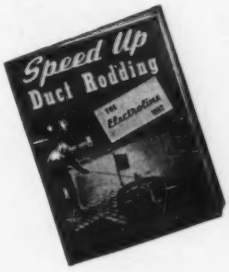
EASY DOES IT!—It's all in a day's work with Electroline Steel Duct-Rodding Equipment rodding 10,000 feet of conduit!

Light in weight, easily handled and stored, low upkeep: these are a few of the advantages utility men know to be true. But even bigger, more important advantages are—

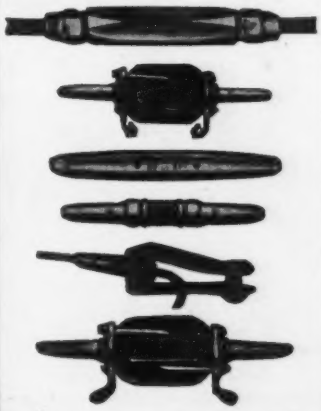
- *Savings in the cost of labor*—for example, where it formerly took two gangs from one to two weeks on a given job, one gang, *in one-half hour*, has completed the same job—using Electroline Duct-Rodding Equipment.
- *Savings in original cost*—you get long life—double that of other types—when you buy Electroline Duct-Rodding Equipment. Add to that this fact: this equipment costs just about half as much for equivalent capacity! *There's true economy.*
- *Savings in Total Investment*—fewer sets are required because of the speed with which a job is completed and the equipment moved to other locations.

Speed up installation, reduce your costs; start now to use Electroline Duct-Rodding Equipment. Available for 3", 3½" or 4" Duct.

We've got a 4-page brochure which describes and illustrates more completely how this equipment can benefit you. We'll gladly send you a copy. Write us.



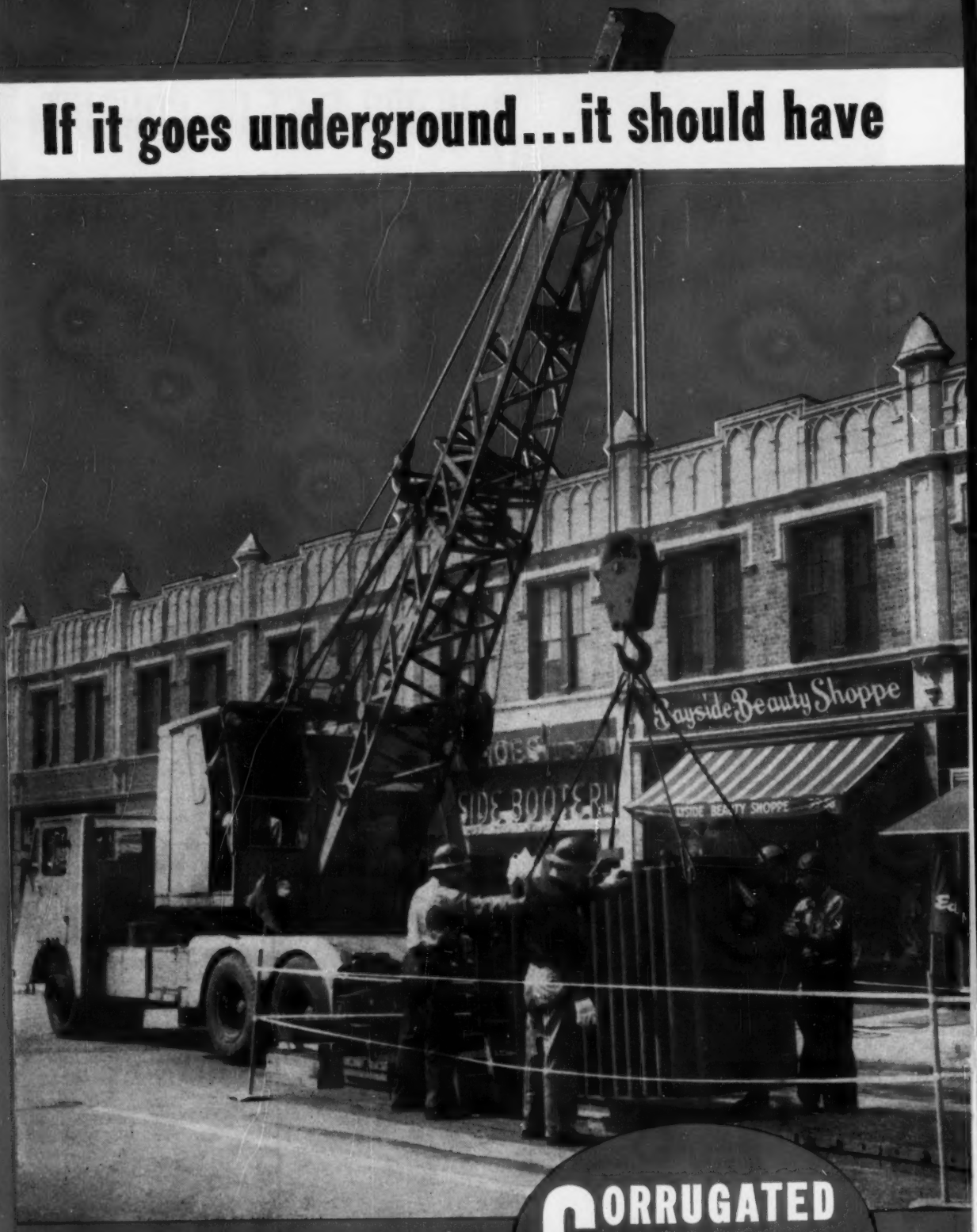
OTHER *Electroline* PRODUCTS



Electroline Company

4121 South La Salle St., Chicago 9, Ill.
In Canada: POWERLITE DEVICES, LTD., TORONTO

If it goes underground...it should have



Men lowering a 500-kva Pennsylvania Corrugated-Cooled Network Transformer into a street vault.

CORRUGATED COOLING

CORRUGATED COOLING

featured in PENNSYLVANIA SUBWAY-TYPE NETWORK TRANSFORMERS

In Pennsylvania Network Transformers, radiating chambers in corrugated form replace conventional tubes and radiators. The result is a tank with straight, smooth, vertical surfaces — a tank easy to clean, easy to paint; a tank designed with your maintenance problem in mind.

That's why Pennsylvania Corrugated-Cooled Network Transformers are easiest of all to maintain in subway vaults, where tanks, and particularly tubes and radiators, can be eaten away at a rapid rate by the corrosive action of water, sludge, salt, and sewage.

Since all four sides of the corrugated tank are completely vertical, there are absolutely no hidden or hard-to-get-at places. Thus, all four tank walls can be thoroughly cleaned and even painted from above the transformer. For even further protection, cases, covers, and tank bottoms are fabricated of Cor-Ten steel, which has an inherent resistance to corrosion that is two to three times better than that of copper-bearing steel.

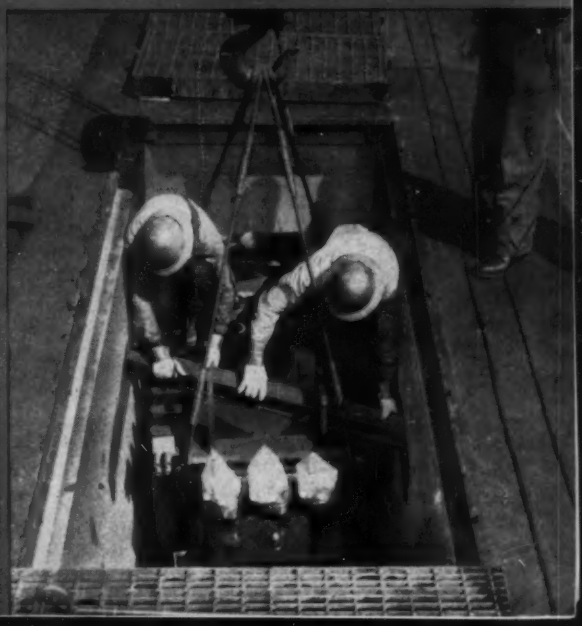
You'll want to know more about Corrugated Cooling. A letter addressed to Ira Horne, manager of Pennsylvania Transformer Company's power sales department, will bring a fast reply.

PENNSYLVANIA TRANSFORMER COMPANY

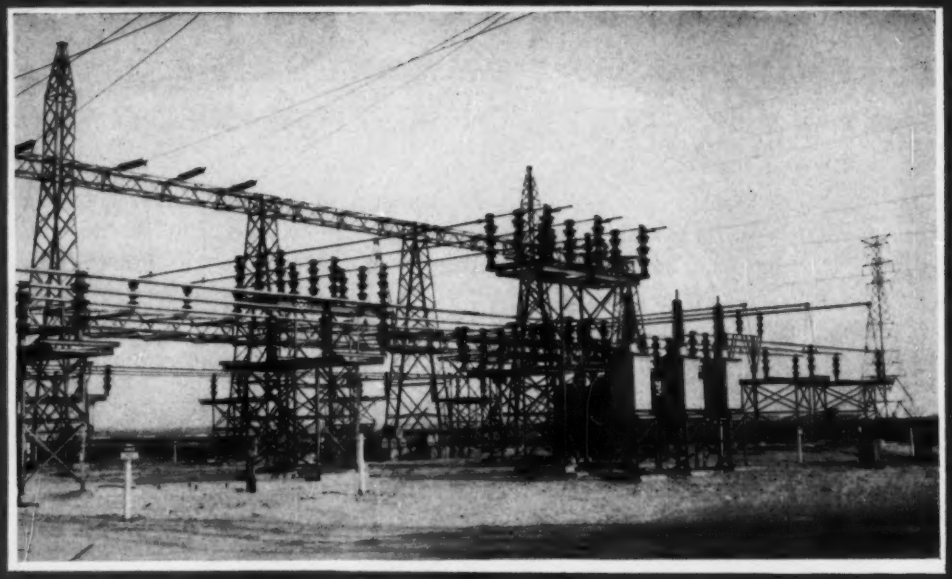
A McGraw Electric Company Division **CANONSBURG, PA.** Greater Pittsburgh District

Small size and low height of Corrugated-Cooled transformer permit installation of larger ratings in small vaults.

Men fasten I-beam into position into wall recesses for suspension mounting of Corrugated-Cooled transformer.



POWER SWITCHING EQUIPMENT AND CONNECTORS



Personalized service by an independent designer and manufacturer who makes it his business to understand your power switching equipment problems and help you find solutions.

MEMCO *Personalized service*

ENGINEERING & MANUFACTURING COMPANY, INC.
COMMACK, L. I., N. Y.

THIS IS HONEYLITE®

Bright as a summer day

quiet as a winter night

Honeylite—the all metal light diffusing acoustical aluminum honeycomb—sets new highs in light transmission efficiency...and at the same time, and in the same place... reduces noise to new lows.

Honeylite's 95% plus efficiency puts a soft, even light in every corner of the room, while producing the minimum surface glare.

Honeylite's noise reduction coefficient of .46 keeps rooms quiet, and costs down by eliminating the need for acoustical baffles.

Honeylite may be used wherever pleasant, non-glare interior light is the goal. Because it weighs only two ounces a square foot it can be suspended from any simple T-bar system.

Fireproof Honeylite has underwriter's approval to be suspended under sprinkler systems; and its 45° shielding effect completely hides any ugly overhead utility installations.

Easy-to-maintain Honeylite is used in industrial or commercial interiors, in suspended louver-all ceilings or troffer diffusers.

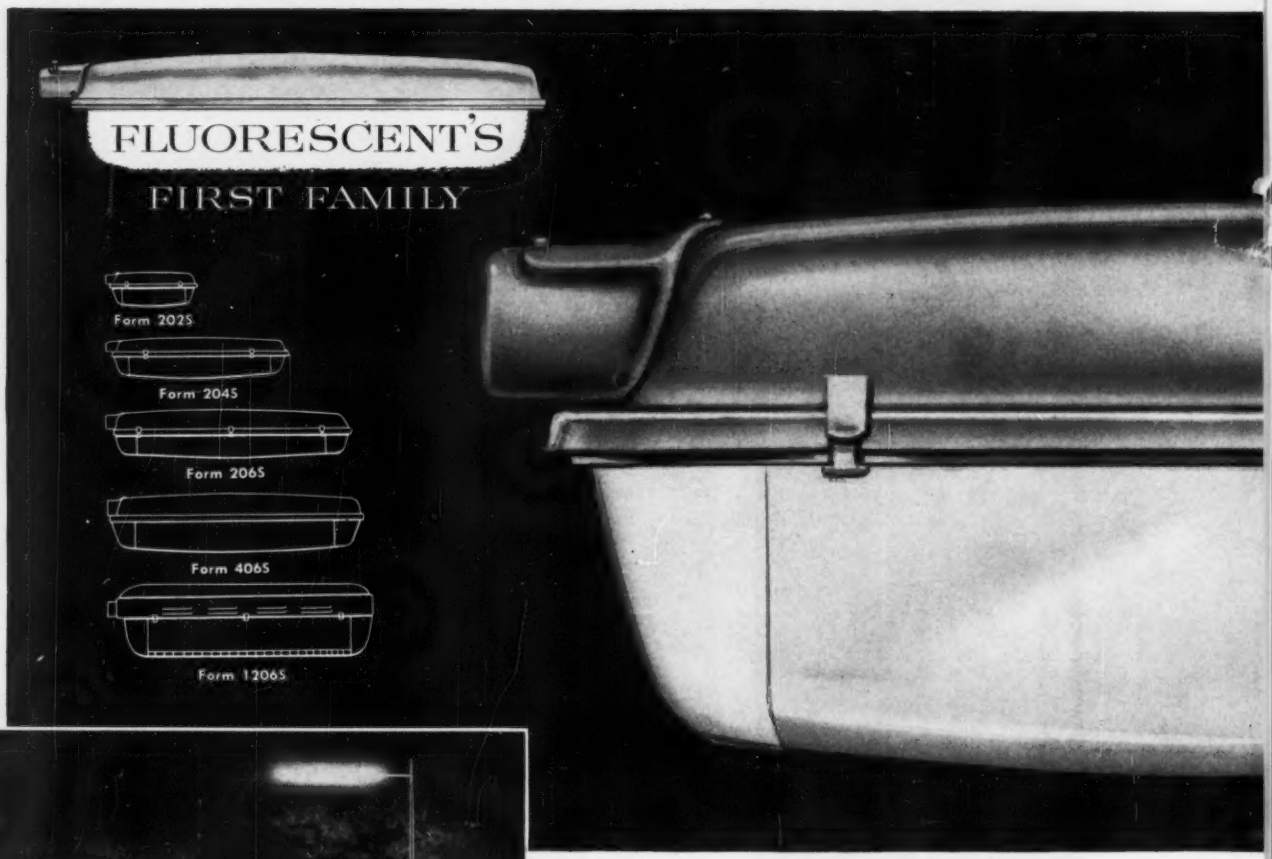
Honeylite is truly the new lightweight champion! For price lists and detailed information see your local distributor or write to

HEXCEL PRODUCTS INC.

951-61st Street, Oakland 8, California

New G-E form 202S Fluorescent

adds safety to residential areas—



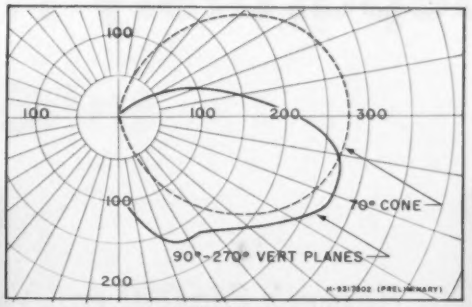
FLUORESCENT STREET LIGHTING promotes safety, better seeing. In addition, when property is lit, residents tend to maintain and improve property appearance, take more pride in the way they live.

The new G-E Form 202S luminaire (2700 lumens) means that now you can bring the assets of main street lighting to the residential areas of a community. Better visibility through fluorescent street lighting makes residential and suburban areas safer and more attractive. Safer . . . because with better seeing, accidents are reduced, people and property are protected—prowlers avoid light. More attractive . . . because the soft, "cool white" light makes seeing more comfortable, increases real estate values, and enhances property appearance.

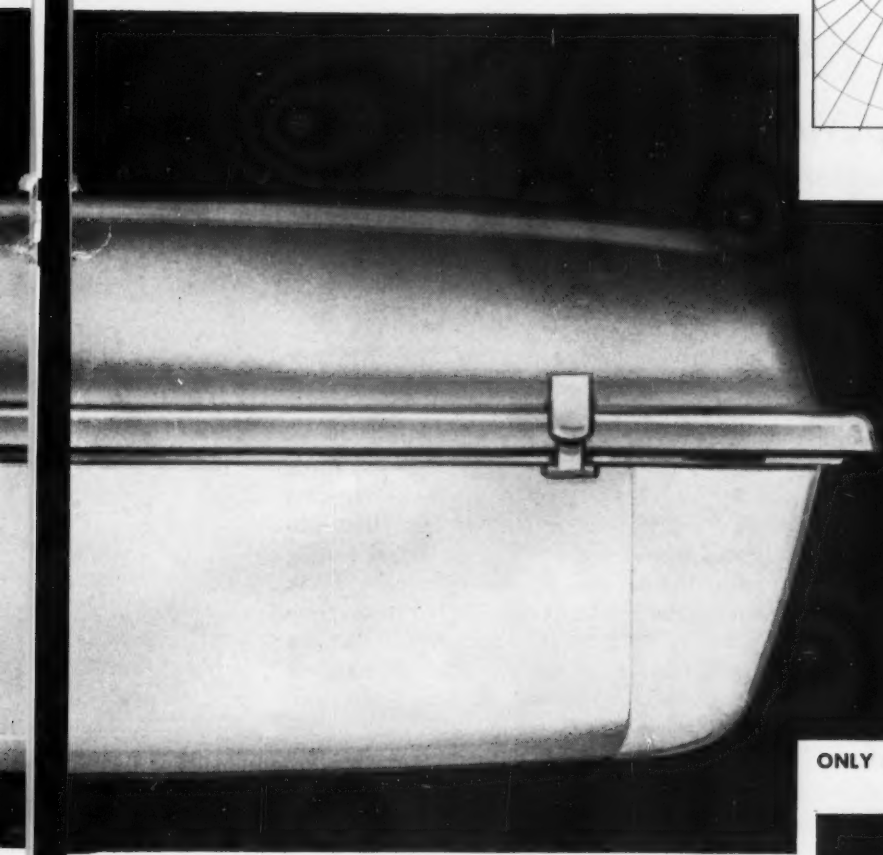
The Form 202S luminaire is another member of G.E.'s revolutionary family of fluorescents, now making it possible to bring all the advantages of this type of street lighting—better visibility, more comfortable seeing, lower maintenance—to every street in the community. It's a development made possible by a coordinated design of luminaires, lamps, ballasts, and brackets for outdoor service. And each member of this family—whether it's the 202S (2700 lumens), 204S (6600 lumens), 206S (10,600 lumens), 406S

Luminaire

increases property values



DISTRIBUTION OF INITIAL CANDLE POWER



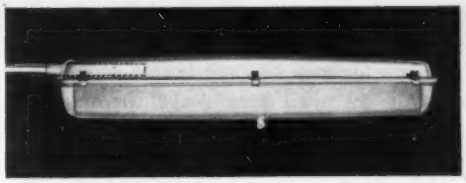
(21,200 lumens), or 1206S (64,000 lumens)—contains many new structural design improvements to assure installation, operating and maintenance advantages. Some of these advantages are slipfitter mountings, weatherproof engineering, one-piece side-hinged globe, detachable reflector, pre-wired terminal board, integral ballasts, and new, recessed, double-contact-base lamps.

For more information on the outstanding new General Electric Form 202S or any other member of "Fluorescent's First Family," contact your nearest G-E Apparatus Sales Office, or write Section 452-162, General Electric Company, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

ONLY NEW G-E FLUORESCENT LUMINAIRES OFFER ALL THESE FEATURES



SLIPFITTER MOUNTING . . . pipe bracket slides easily into luminaire, giving perfect support and eliminating heavy, cumbersome clamp brackets. Simple, self-contained, two-bolt adjustment permits fast, easy leveling.

WEATHERPROOF ENGINEERING . . . new, resilient gasketing material between hood and globe provides a uniform, positive seal against all elements. One-piece plastic globe retains clear appearance in all weather.

Separately Fired Superheaters Cut Cost of Atomic

Con Edison's 236,000 kw Nuclear Power Plant will depend upon FW superheaters for 96,000 kw of its capacity and save about 27% in total plant cost per kw

FOSTER WHEELER will supply the superheaters for the Indian Point Plant of Consolidated Edison Company of N.Y., to be located on the Hudson River, 24 miles north of New York City. The design of these units reflects Foster Wheeler's more than 60 years of experience in building superheaters for major power plants from coast to coast—including more than 18,000 units and over 90% of all the radiant superheaters in use today.

This Indian Point project represents an important forward step toward the economical generation of electricity from nuclear power. For it is the nation's first atomic power plant to utilize separately-fired superheated steam and demonstrate the cost-saving effects of this method of generation.

Saturated steam from the new pressurized water reactor will be superheated from 447F to 1000F by two Foster Wheeler separately-fired superheaters, each with a capacity of 1,075,000 lb per hr at an operating pressure of 410 psia. Initially oil-fired, the superheater design will be such that convenient conversion to coal firing may be accomplished, if desired, at some future date.

The decision to use separately-fired superheaters for the Indian Point plant was made after detailed economic studies, comparing plant capacity and initial cost, as well as estimated annual power costs, for plants operating on saturated and superheated steam. These studies included superheating the steam from 447F to 860F, 1000F and 1050F, but the 1000F superheat was found to be the most economical. Compared to operation with saturated steam direct from the reactor to the turbine, addition of the superheat cycle raised plant capacity from 140,000 kw to 236,000 kw, and resulted in a reduction in estimated plant cost from $322 per kw to $233 per kw. These comparative cost and capacity figures are tabulated below. The use of superheated steam will also reduce turbine maintenance, further contributing to lower cost of atomic power generation.

Foster Wheeler's long experience in steam generation and specialized nuclear know-how, offers a valuable service to the power industry, for the planning and construction of both nuclear and fossil fuel fired steam plants of the future. For further information, write to *Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.*

ESTIMATED COST AND CAPACITIES

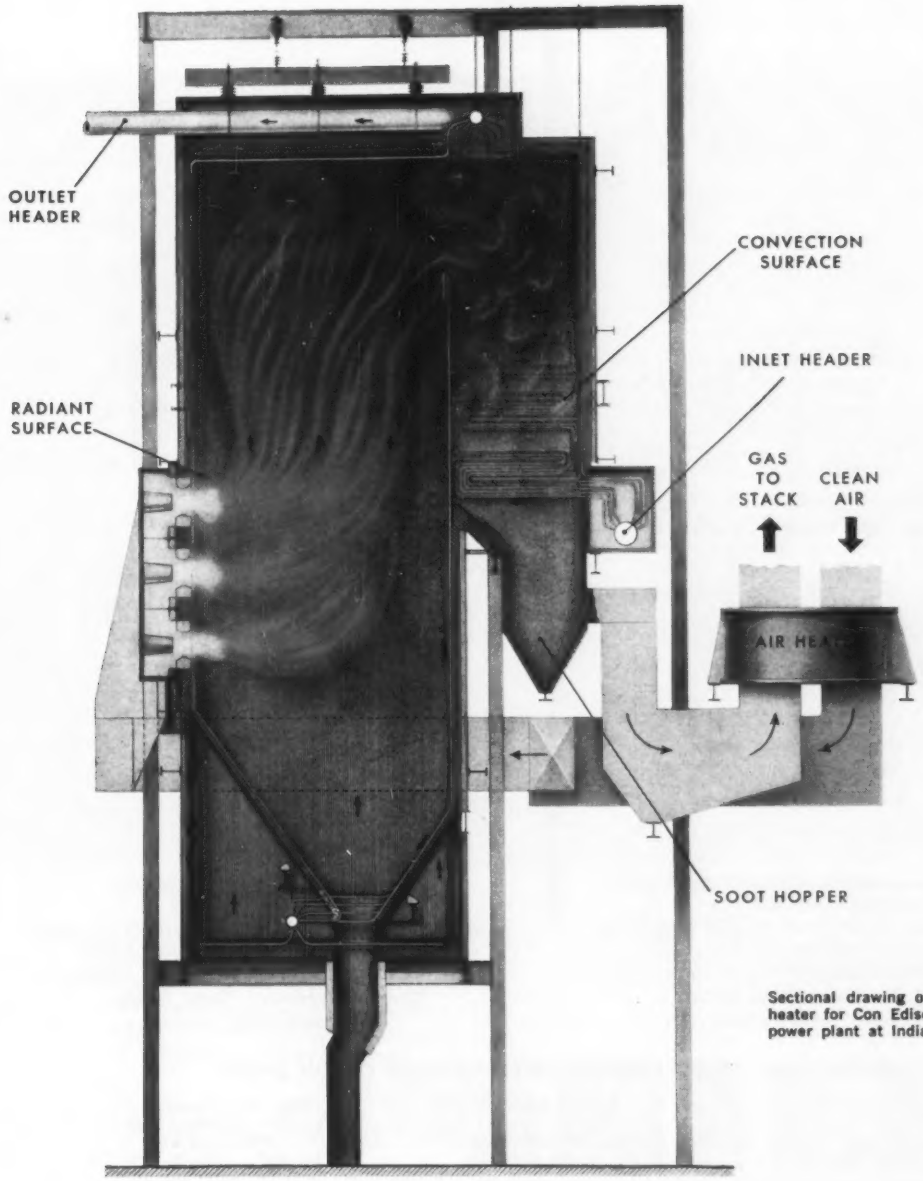
	Total Plant Cost	
	Saturated Steam	Superheated Steam
Steam Pressure at Boiler, psia.....	420	420
Steam Pressure, Turbine Inlet, psia.	405	370
Steam Temperature, Turbine Inlet..	446F	1,000F
Turbine Plant Heat Rate, Btu/kwhr..	12,900	10,700
Gross Electrical Output, kw	140,000	236,000
Total Cost of Plant, million $.....	45	55
Total Plant Cost Per kw, $.....	322	233

FOSTER

NEW YORK • LONDON

by FW

Power at Indian Point



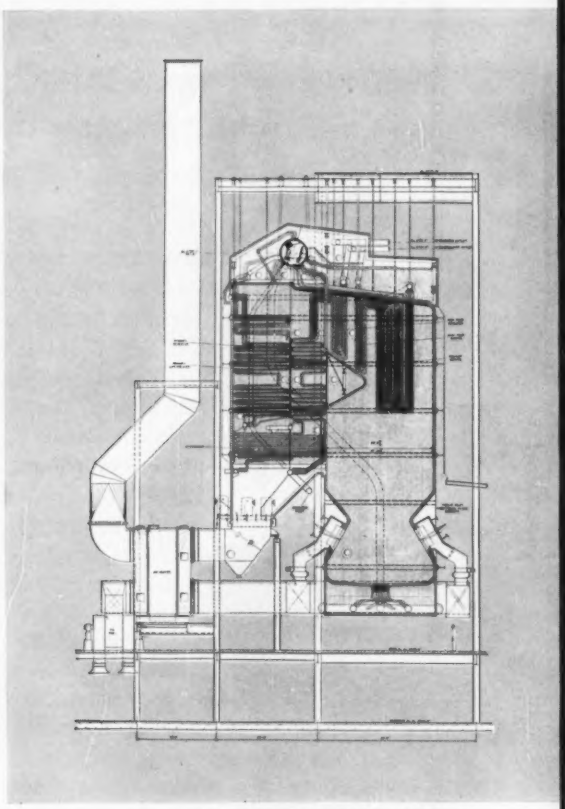
Sectional drawing of separately-fired superheater for Con Edison's 236,000 kw nuclear power plant at Indian Point, N.Y.

WHEELER

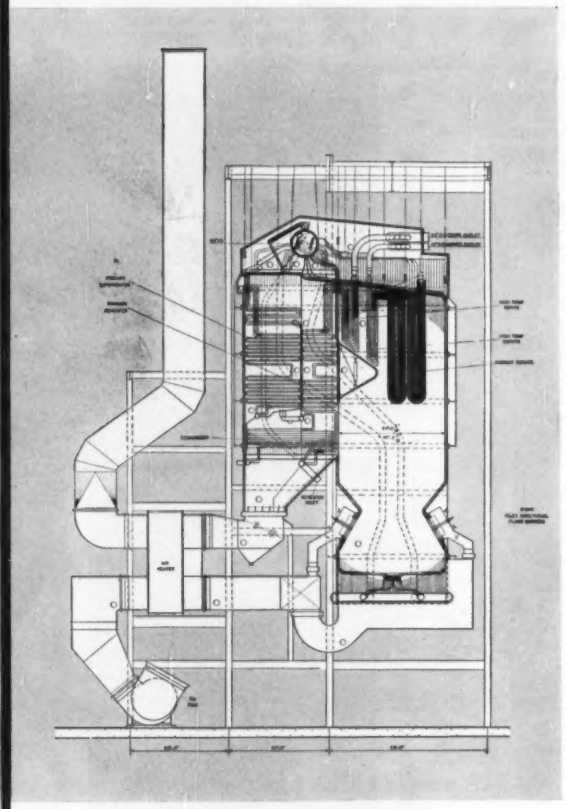
PARIS • ST. CATHARINES, ONT.

why southern and southwestern

RILEY TURBO



Riley Reheat TURBO FURNACE Unit:
For Texas Public Utility
Capacity: 825,000 lbs/hr. Pressure: 1750 psig design
Superheat and reheat temperatures: 1005 F
Fuels: Natural Gas, Oil, Future Coal
12 Riley Directional Flame Burners
Pressurized Turbo Furnace



Riley Reheat TURBO FURNACE Unit:
For Texas Public Utility
Capacity: 1,250,000 lbs/hr. Pressure: 2125 psig
Superheat and reheat temperatures: 1005 F
Fuels: Natural Gas, Oil and Future Lignite
16 Riley Directional Flame Burners
Pressurized Turbo Furnace

OTHER RILEY TURBO FURNACE UNITS INSTALLED OR ON ORDER

Northeast Paper Mill
One 175,000# Unit
Pulverized Coal

West Va. Chemicals Co.
One 289,000# Unit
Pulverized Coal

Eastern Seaboard
Public Utility
Three 500,000# Units
Fluid Coke

Southern Aluminum Co.
Three 320,000# Units
Gas, Oil, Future Coal

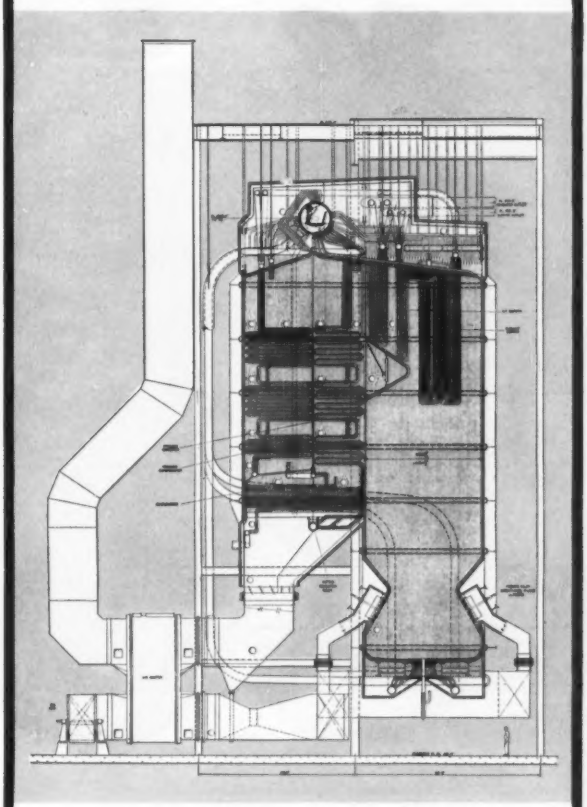
West Va. Chemicals Co.
One 175,000# Unit
Pulverized Coal

Florida Public Utility
One 600,000# Unit
Reheat — Oil

RILEY DESIGNS, MANUFACTURES AND INSTALLS COMPLETE STEAM GENERATING UNITS AND FUEL BURNING EQUIPMENT FOR PUBLIC UTILITY AND INDUSTRIAL POWER AND HEATING PLANTS

public utilities are installing

FURNACE UNITS



Riley Reheat TURBO FURNACE Unit:
Louisiana Public Utility
Capacity: 1,550,000 lbs/hr. Pressure: 2125 psig design
Superheat and reheat temperatures: 1005 F
Fuels: Natural Gas, Future Oil, Pulverized Coal, Lignite, Delayed Coke, Fluid Coke.
20 Riley Directional Flame Burners
Pressurized Turbo Furnace

A survey of your plant by a consulting engineer could show ways of making surprising savings in your power costs.

BECAUSE . . . the TURBO FURNACE makes possible change-over from natural gas and oil to solid fuels firing with minimum of outage and minimum conversion cost . . . at the same time it provides a superior, efficient means of firing gas or oil.

When conversion to solid fuels becomes economically advisable the only major expense is the addition of pulverizers. Riley Directional Flame Burners are already equipped with coal heads for easy, quick hook-up to pulverizers.

USES A WIDE RANGE OF FUELS

The method of firing and the high heat and high turbulence in the combustion zone makes possible the efficient and economical use of any fuel that is burned in suspension: gas, oil, all grades of coal, lignite, delayed cokes and fluid coke.

OFFERS MANY ADDED ECONOMIES

- Flyash disposal is eliminated by reinjecting flyash and converting it to slag.
- **Minimum carbon loss, higher efficiency.**
- **Clean furnace — no soot or slag blowing is needed; a large percentage of ash is retained in combustion zone and furnace exit gas temperatures are exceptionally low.**
- **More uniformity of furnace temperature across superheater and reheater.**
- **Method of firing makes possible less overall height.**
- **One level burner operation.**

REMOTE AND ELECTRONICALLY CONTROLLED FIRING

Complete automatic and remote firing controls with electronic safeguards are available for Riley Directional Flame Burners.

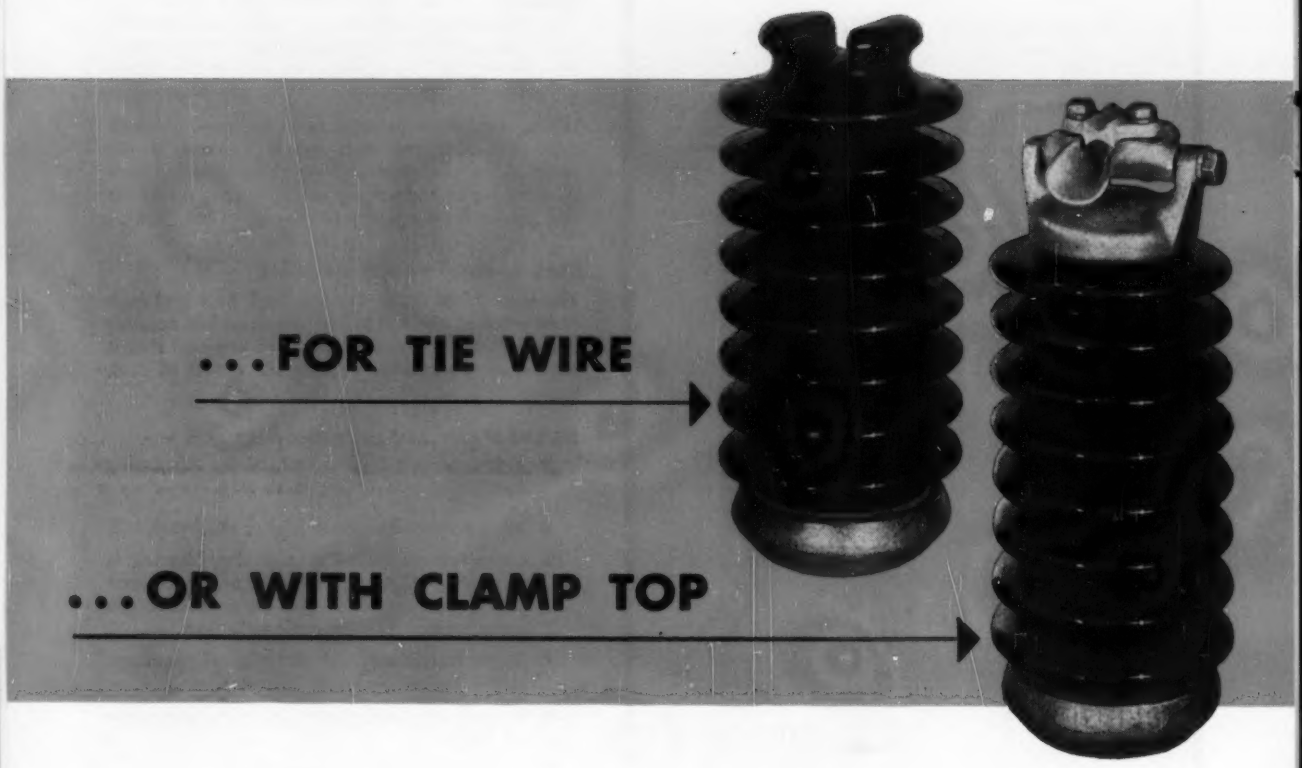
RILEY

Stoker Corporation

WORCESTER, MASSACHUSETTS

Sales Offices: Worcester, New York, Philadelphia, Buffalo, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Houston, Denver (Englewood), Salt Lake City, Los Angeles, San Francisco, Portland, Seattle.

Lapp builds the Line Post

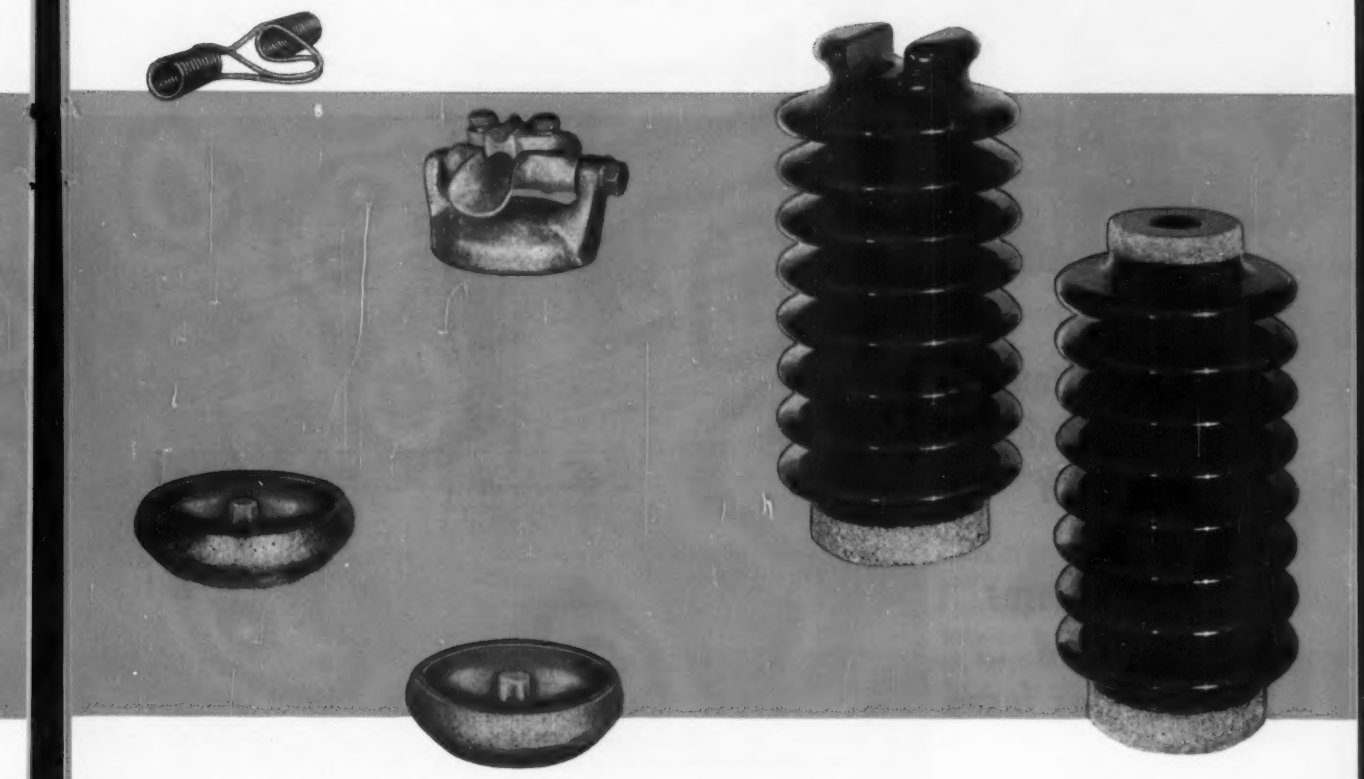


Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

This is the hardware

This is the insulator



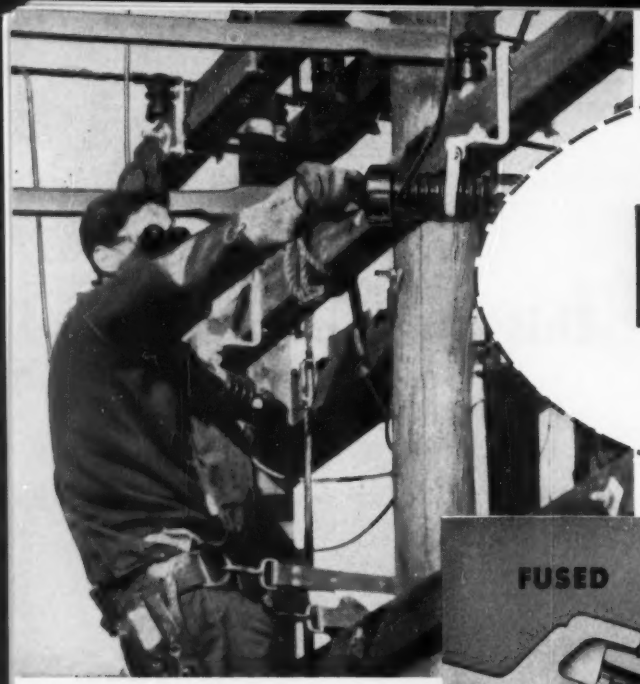
For tie-wire installation, the Lapp Line Post provides a deep, square-side top groove. Such an installation provides a "mechanical fuse"—the conductor can slip through to relieve structure load in case conductor breaks.

With clamp-top assembly, the Lapp Line Post provides for easiest installation or change-out of any clamp-top design. A single cap screw with captive washer is the only loose part throughout installation. For change-out, the clamp stays on the conductor. All clamps are interchangeable on all sizes of Lapp Line Posts

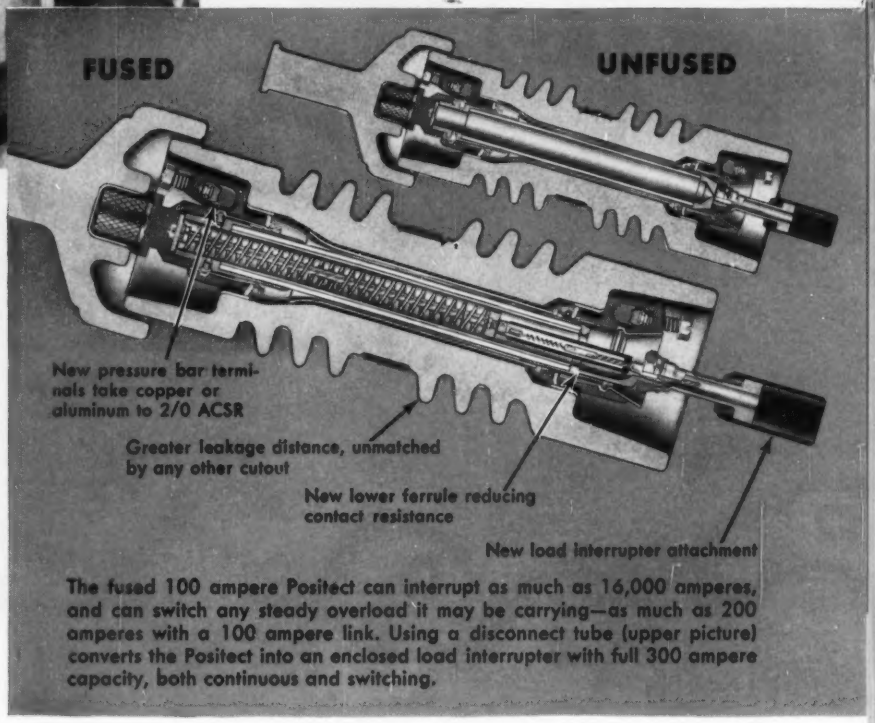
In either type of assembly, the tie-wire, the base or the clamp top are mechanical parts. Their function is only to attach the conductor to the insulator and the insulator to cross arm or pole—and to provide such attachment in a way that will permit the insulator to do its job faithfully.

With either tie-wire or clamp-top construction, the *insulator* is the porcelain post. It is a closed-end post of Lapp electrical porcelain of fog-type design. Its uniform long leakage path prevents leakage flashover in contaminated atmosphere. It has exceptional stamina under arcover and attack by stones and bullets because short, strong petticoats protect its sturdy body. It won't puncture because it has no conductive material within it. It won't crack, because its hardware . . . top and bottom . . . is *externally* attached, and can load the porcelain only in compression.

The Lapp Line Post will improve your service record and your maintenance record by providing an *extra* margin of operating security, low upkeep and long life.



. . . a new S&C Positect CUTOUT


FUSED
UNFUSED
New pressure bar terminals take copper or aluminum to 2/0 ACSR
Greater leakage distance, unmatched by any other cutout
New lower ferrule reducing contact resistance
New load interrupter attachment

The fused 100 ampere Positect can interrupt as much as 16,000 amperes, and can switch any steady overload it may be carrying—as much as 200 amperes with a 100 ampere link. Using a disconnect tube (upper picture) converts the Positect into an enclosed load interrupter with full 300 ampere capacity, both continuous and switching.

the only enclosed cutout for load switching . . . now with ratings to 300 amperes unfused . . . 200 amperes fused

By means of a new load interrupter attachment, the S&C Positect now provides full load switching. This new capability is designed to take care of the heavier loads on today's feeders.

The S&C Positect is the only enclosed cutout for load switching. Moreover, its action is positive. There is no external arc—no exposed hot parts. No links are broken.

Load switching capability is not the only "plus" for the Positect. For short circuit protection it's tops, too, besides having unique safety features for the lineman:

1. It is designed and tested for closing against a fault —"make" as well as "break."
2. Blast is directed away from the operator, so he is out of reach of the arc, flame and "shrapnel" in case he closes on a fault.
3. Kickback is prevented by high inertia of the fuse tube as it is driven home, directly opposing the recoil forces.
4. Blast is minimized by arc shortening and freer venting.

Specialists in High-Voltage Circuit Interruption since 1910

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.

In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

ELECTRICAL BUSINESS OUTLOOK

Electrical World
NOVEMBER 26, 1956

Don't look for any letup in the steady round of price hikes you've suffered through this year. There are indications now, that things will get worse before they get better.

Financing capital expansion programs gets more expensive every day. You get some idea of what's in store when you consider the recent experience of New Jersey's Public Service Electric & Gas Co in the bond market. To finance $50 million of "Aa" grade bonds, Public Service agreed to a 4.34% yield basis—the highest rate for a comparable grade public utility since 1935.

• • •

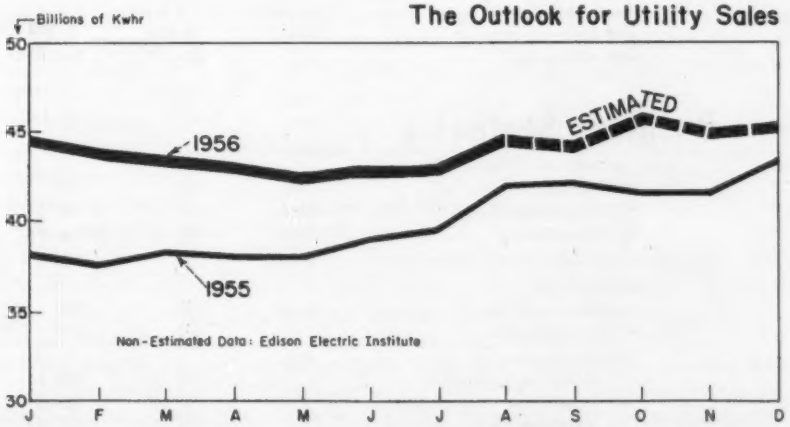
But financial headaches are not strictly the province of the utility industry. The electrical manufacturing industry has its share. At the recent meeting of the National Electrical Manufacturers, Ralph Cordiner, president of General Electric outlined some of the problems the industry faces.

Electrical manufacturers have an opportunity to increase their sales to 4½ times the present level of $20 billion a year by 1976, according to Cordiner. To hit this target, electrical manufacturers will have to invest substantial capital in research, development, modernization, expansion and development of manpower and markets. Prices, of course, will reflect these enormous capital requirements. But, adds Cordiner, . . .

"Current levels of prices and earnings in the electrical manufacturing industry will not support the required expenditures for these purposes in years ahead." To illustrate his remarks, Cordiner pointed out that in 1955 the electrical manufacturing industry paid out $129 million more in cash than it generated through earnings and depreciation.

Electrical machinery and equipment prices have risen 100% since 1929, added the GE president. But, during the same period hourly wages in electrical manufacturing have gone up 178% while prices of key raw materials have risen 163%. Cordiner attributed the ability of the industry to absorb their higher cost to increased volume and efficiency. However, he points out that no industry can absorb so much cost increase in so few years, and still finance essential growth and compensate its investors adequately.

The Outlook for Utility Sales



STATISTICS

Growth In Electrical Manufacturing: 1947 to 1954

	Number of Employees (Thousands)			Value Added By Manufacture (Millions)		
	1947	1954	% Change	1947	1954	% Change
Electrical Machinery	796	951	+19.5	$3,860	$7,399	+91.7
Electrical Industrial Apparatus	315	342	+8.6	1,579	2,795	+77.0
Wiring Devices & Supplies	39	43	+10.3	219	340	+55.3
Carbon & Graphic Products	8	8	0	40	63	+57.5
Measuring Instruments	21	33	+57.1	104	248	+138.5
Motors & Generators	125	115	−8.0	564	851	+50.9
Transformers	37	42	+13.5	195	417	+113.8
Electric Control Apparatus	67	78	+16.4	358	690	+92.7
Electric Welding Apparatus	7	8	+14.3	57	80	+40.4
Other Electrical Apparatus	11	15	+36.4	41	107	+161.0

Source: U. S. Department of Commerce, Bureau of Census

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Sept.	118.66	118.01	110.91	7.0
Peak—Class 1 Systems, million kw	Aug.	98.0	94.8	91.7	6.9
Estimated Dec. '56 Peak, million kw	Aug.	106.10	106.09	103.83	2.2
Production—billion kwhr	Sept.	48.82	52.19	46.33	5.4
Hydro		8.96	9.54	8.18	9.5
Fuel		39.86	42.66	38.18	4.4
Sales—billion kwhr	Aug.	46.11	44.57	43.37	6.3
Residential		11.60	11.38	10.52	10.3
Commercial		7.95	7.74	7.40	7.4
Industrial		23.78	22.71	22.76	4.5
Other		2.78	2.73	2.68	3.7
Fuel Consumption	Sept.				
Coal—million tons		12.45	13.18	12.07	3.1
Oil—million barrels		5.20	5.18	5.18	0.4
Gas—billion cu ft		124.63	142.04	119.85	4.0
Net Income Class A & B Co's—$ million	Sept.	108.45	97.17	100.18	8.3
Residential Customers—millions	12 mos.	45.25	45.10	43.95	3.0
Revenue per kwhr	ended	2.61¢	2.61¢	2.66¢	−1.9
Avg kwhr per customer	Aug. 31	2,914	2,899	2,682	8.7
Avg annual bill		$76.06	$75.66	$71.34	6.6

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Oct.	150	145	147	2.0
ENR Construction Cost	Nov.	147.6	147.6	141.1	4.6
BLS Cost-of-living	Sept.	117.1	116.8	114.9	1.9
New Orders for Machinery (1950 = 100)	Sept.	138	142	126	9.5
NEMA Sales					
Insulation materials	Sept.	147	153	156	−5.8
Electric appliances		101	100	114	−11.4
Wholesale prices	Aug.				
Motors and generators		133.3	133.1	121.8	9.4
Transformers and regulators		139.7	134.5	127.3	9.7
Switchgear and fuses		153.8	152.6	139.2	10.5
GNP—annual rate—$ billion	3rd Qtr.	413.8	408.3	396.8	4.3

Your Business

Safety hints. You're likely to be safer on your job than puttering at your favorite sport. Counting up lost-time injuries among its 100,000 employees, E. I. duPont de Nemours & Co found that 515 were hurt while participating in sports during the past three years. Only 265 incurred loss-time injuries on the job during the same periods. Breakdown: Baseball, 202; basketball, 58; swimming, 43; football, 26; volley ball, 11. Skating, hunting, fishing, bowling, boating, and an assortment of other sports accounted for the remainder. One answer, the duPont Co believes, is to promote outside safety programs in the same way that on-the-job programs are promoted.

Another load builder. Dampp-Chaser, Inc, manufacturer of small 8-watt heating units for chasing the moisture out of fine pianos is now set to crack the consumer market. They say their device can be used to improve performance of TV sets, phonographs.

Be where they buy. Polk Bros, a Chicago appliance dealer, has introduced a portable store for selling merchandise where customers congregate. The big, 108 ft long, 50 ft wide, 30 ft high, structure is suitable for numerous other uses such as disaster shelters and public meeting houses.

"Pardon me, Burton. I was worrying over our 18 million dollar construction budget for this year. Now what's this nonsense about you needing a four dollar raise?"

Maybe the race is not always to the swift, nor the battle to the strong, but that's the way to bet."—Damon Runyon.

Your Health — Polio Vaccine

REX H. WILSON, MD, Medical Director, B. F. Goodrich Co.

Now that we have a vaccine that has been proved to be effective in the prevention of poliomyelitis a common question is—who should be vaccinated? The answer is—everyone! It is a must for children and expectant mothers, but no one is immune. So, why not get it? Eventually everyone up to at least 45 years of age will be urged publicly to be immunized. Early in the development of the wonderful discovery of Dr. Jonas E. Salk there was the question, "How safe is the vaccine?" Rest assured, all vaccine now available is safe. Any manufacturing "bugs" that have occurred have now been eradicated. Vaccine is being made available in ever-increasing amounts.

To secure proper immunity, three injections or doses of the vaccine are necessary. Each shot is given into the arm, either into the muscle or under the skin. You should get the first one at once, the second one two to six weeks after the first, and the third seven months to a year after the second shot.

The first shot begins to take effect seven to ten days after it is given. The second shot increases the immunizing antibodies in the body and probably gives almost full protection against paralytic poliomyelitis. The third shot gives better and longer protection. Full vaccination means three shots.

The vaccine causes a person to develop antibodies which fight the poliomyelitis virus in our bodies. Enough antibodies in our system will prevent the poliomyelitis virus from causing paralysis. There is still a lot of poliomyelitis virus about. You can easily get infected with it, so why take a chance? If everyone were immunized, poliomyelitis would soon be a rare disease.

Recently a vaccine against poliomyelitis was discovered which can be taken orally. This new type of vaccine, however, is still in the trial stage and no one can say when, if ever, it will be ready for general use.

Medical research is ever progressing but right now a safe, effective vaccine against paralytic poliomyelitis is available. It is not expensive and the shots do not hurt. So consult your family physician about being immunized against this dreaded disabling disease today. By being immunized you not only help yourself, but you also help others by reducing the chances of the disease occurring.

WASHINGTON COMMENT

Congress May Get Niagara Issue Again

V. CRAIG RICHTER, Washington Correspondent

The Niagara issue by all indications is heading back to Congress again.

The Federal Power Commission is wasting no time in dealing with application of the New York State Power Authority for a license to undertake the redevelopment. Evidently, FPC wants to wash its hands of the affair before Congress reconvenes.

At the time of writing, a Commission decision was imminent after one day of oral arguments, Nov. 14, as to whether FPC has jurisdiction to handle the case. The commission legal staff contends it does not.

N. Y. Authority Challenges Treaty

The proceeding was the outcome of the contention of the New York Authority that a reservation in the 1950 treaty with Canada was invalid. The reservation retains for Congress the right to name the agency or firm which should undertake the redevelopment of Niagara waters.

Following repeated failure of Congress to reach agreement on who should do the job, the New York Authority this summer sought an FPC license. This immediately raised the question of FPC's jurisdiction. Seven petitioners presented views.

Arguing against the validity of the reservation, in addition to the authority, was Jacob J. Javits, New York Attorney General. On the other side of the argument were lawyers for Rochester Gas & Electric Co (one of the five companies which hope to redevelop Niagara), the American Public Power Association, the National Rural Electric Cooperative Association, and the FPC legal staff.

Although the commission legal staff has recommended dismissal of the case, it does not follow that the Commission will accept this recommendation.

Regardless of how the FPC rules, there are still the courts. But the courts may not be any happier to receive this extremely ticklish legal question than was FPC.

Say Reservation Has No Effect

The authority based its case on the legal opinions of Prof. Philip C. Jessup and Judge Samuel I. Rosenman. They argued in effect that treaty-making powers deal only with international matters and not domestic affairs (the subject of the reservation). Rosenman maintained too, that the reservation had no effect in law since it was passed only by one house of Congress and was not part of the constitution.

John C. Mason, for the commission, held that under the law FPC may not decide the constitutionality of the reservation. Therefore, it must accept its validity and thus has no authority to issue a license.

Northcutt Ely for APPA said that a ratified treaty, including the reservation in question, is a supreme law of the land. This position was supported by Edward F. Huber of Rochester G & E. He said no judicial authority had ever suggested that a treaty provision which deals with a purely domestic matter is invalid.

Congress may decide, as it has in the past, that it can still handle this matter, regardless of whether anyone takes it to court.

TECHNICAL NOTES

High heat-source temperature in nuclear power plants offers promise of the best heat rates that are thermodynamically attainable.

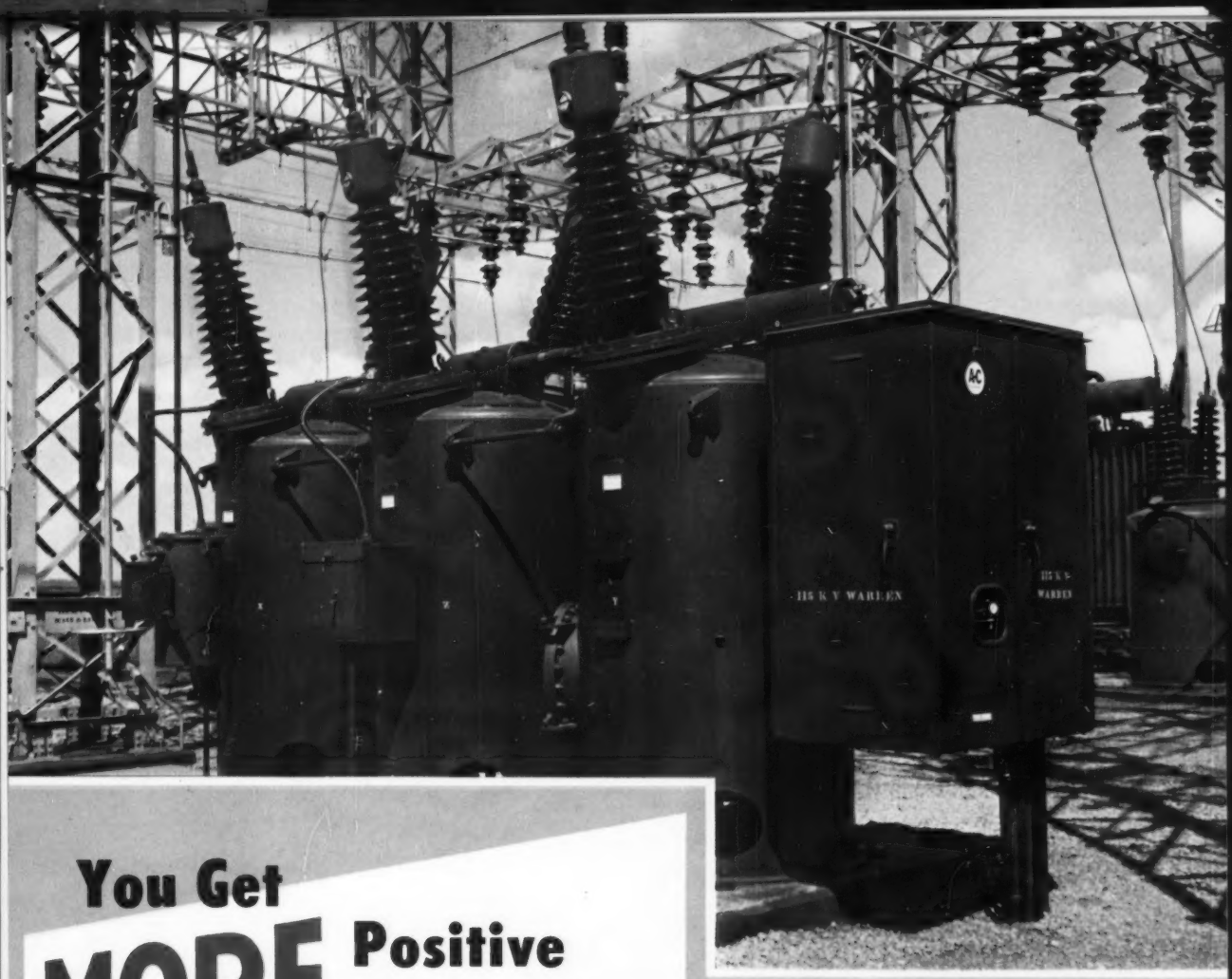
Vaporization of silica occurs at a rate largely dependent upon the temperature of boiler water.

Glass-reinforced, plastic poles may prove to be competitive with wood poles for transmission and distribution, suggests a western utility, if they are available in 5, 10, and 20-ft joinable sections. A long-range economic analysis should include: Smaller pole inventory to release pole-yard space for other storage; ease of transportation, field handling, and erection; less-costly replacement of accident-prone poles in urban areas; ease of adding height to poles; and much longer, maintenance-free service life.

Omission of ballasts from mercury lamps in a series street-lighting system is expected to save 20% investment and 10-15% annual operating cost.

Insulator shape and size have little bearing on the contamination deposited on the surface by fog.

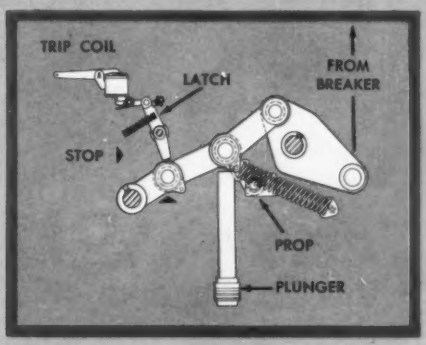
Fly ash in concrete for underwater placement reacts with lime liberated by hydrating the cement to form strong, insoluble compounds. Other gains in addition to savings of cement are an easier flowing of the mix and delayed initial set.



You Get MORE Positive Protection

with Allis-Chalmers Mechanically Trip-Free Breakers

This 115-kv Allis-Chalmers breaker in eastern utility substation features Mechanically Trip-Free *Pneu-Draulic* operator.



Simple uncoupling linkage permits contacts to open regardless of position of closing mechanism.

● Only Allis-Chalmers power circuit breakers open at full speed under all conditions . . . because only Allis-Chalmers builds *all* breakers fully Mechanically Trip-Free. *Pneumatically or hydraulically trip-free breakers cannot give you this protection.*

For details of this and other features, such as the *Pneu-Draulic* operator and the completely tested *Turbo Jet* interrupter, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Pneu-Draulic and *Turbo Jet* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

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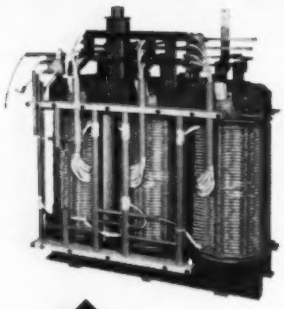
From coast to coast...

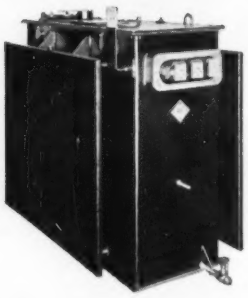
Allis-Chalmers Network Transformers

Are meeting growing system needs with long-term, reliable operation. Compact design, rugged construction, and easy maintenance features make A-C transformers your best buy for network expansion. Call your nearby A-C office for information, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.



COMPACT, LOW-LOSS DESIGN

Thermal capacities are high for severe load conditions. Sturdy, time-proved core and coil construction meets repeated short-circuit stresses of network operation.



PAN-TYPE RADIATORS

This optional design offers advantages in ease of cleaning, painting and handling, with cooling efficiency equal to conventional radiators.

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LIVE BETTER ELECTRICALLY

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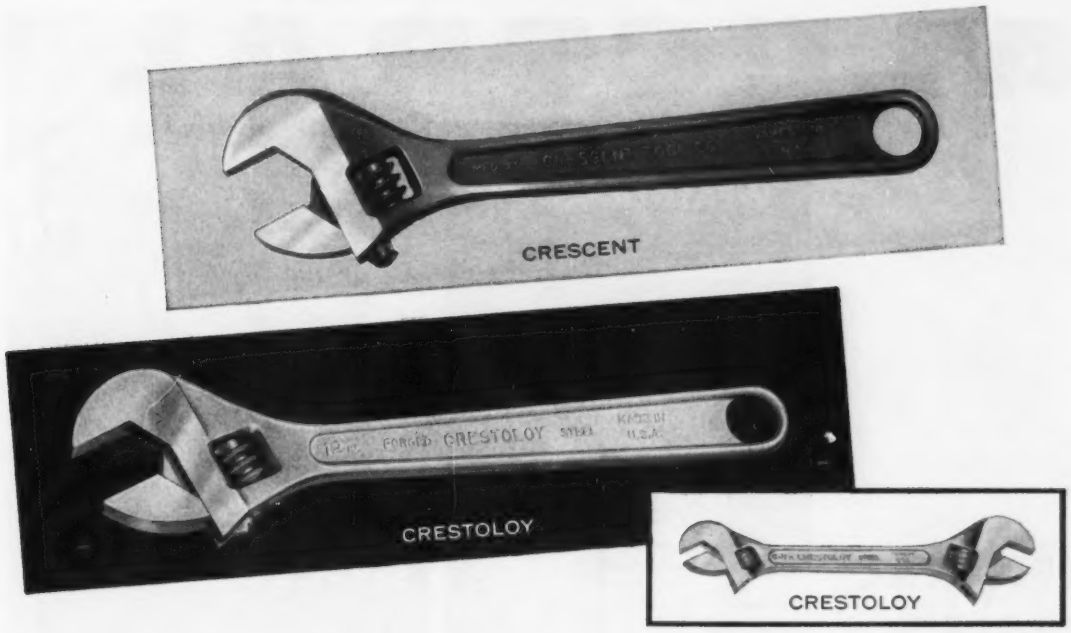


CRESCENT AND CRESTOLOY

outsell all other ADJUSTABLE WRENCHES

CRESTOLOY Wrenches are forged from a special alloy steel permitting thinner, trimmer design with greater strength and less weight than conventional types. They are available in Single End patterns, 4″ to 24″ size. Double-end in four models combining 4-6; 6-8; 8-10; 10-12 inch sizes. The 15″, 18″ and 24″ sizes, available in Single End pattern only, are distinguished by their tapered handles. There is no stronger or finer Adjustable Wrench than CRESTOLOY.

CRESCENT Wrenches are forged from selected carbon steel and specially heat-treated to increase their toughness and durability. Due to their lesser cost and relatively great strength, they are widely used in industrial and service operations where thinness is not essential. Available in Single End Patterns, 4″ to 18″.

Both CRESCENT and CRESTOLOY Wrenches represent the best in design and workmanship, and carry the same guarantee.

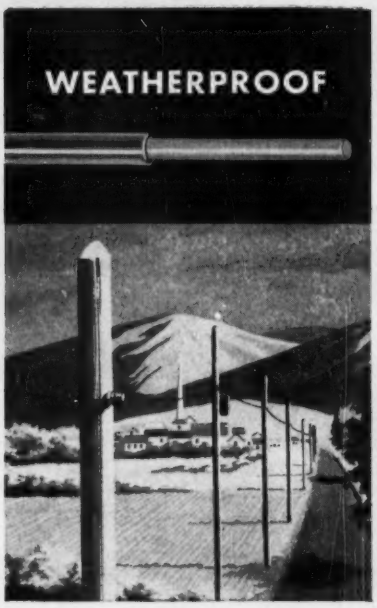
CRESCENT and CRESTOLOY TOOLS are sold by hardware dealers and industrial distributors everywhere. Look for the bright yellow Crescent Display panels and select from one of the world's greatest assortments of quality hand tools.

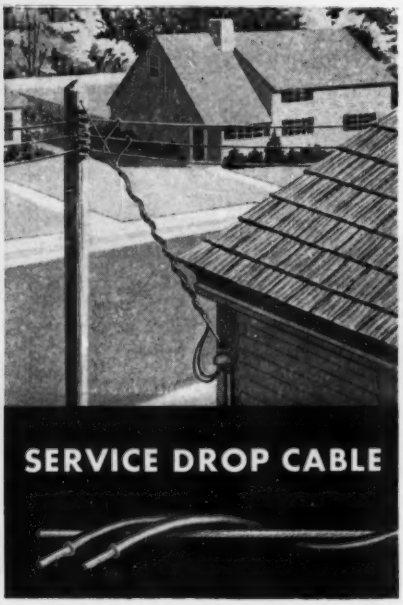
Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

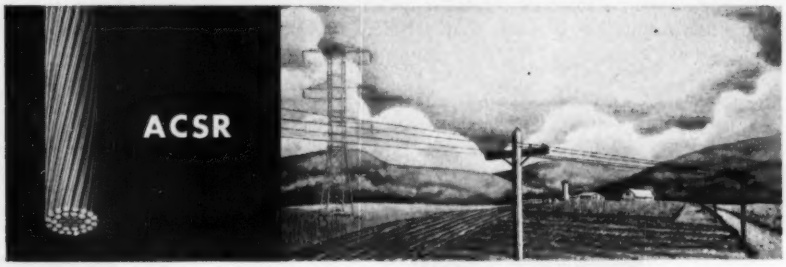
ALECTRAL

GENERAL CABLE'S





ALUMINUM CONDUCTOR



Built into its aluminum products are 75 years of General Cable's engineering and manufacturing experience. In this record are more than 25 years of successful performance of insulated aluminum conductors marketed as ALECTRAL. Available in ALL-ALUMINUM, ACSR, WEATHERPROOF and with RUBBER and THERMOPLASTIC insulations. A sound and economical investment for all voltage ranges.

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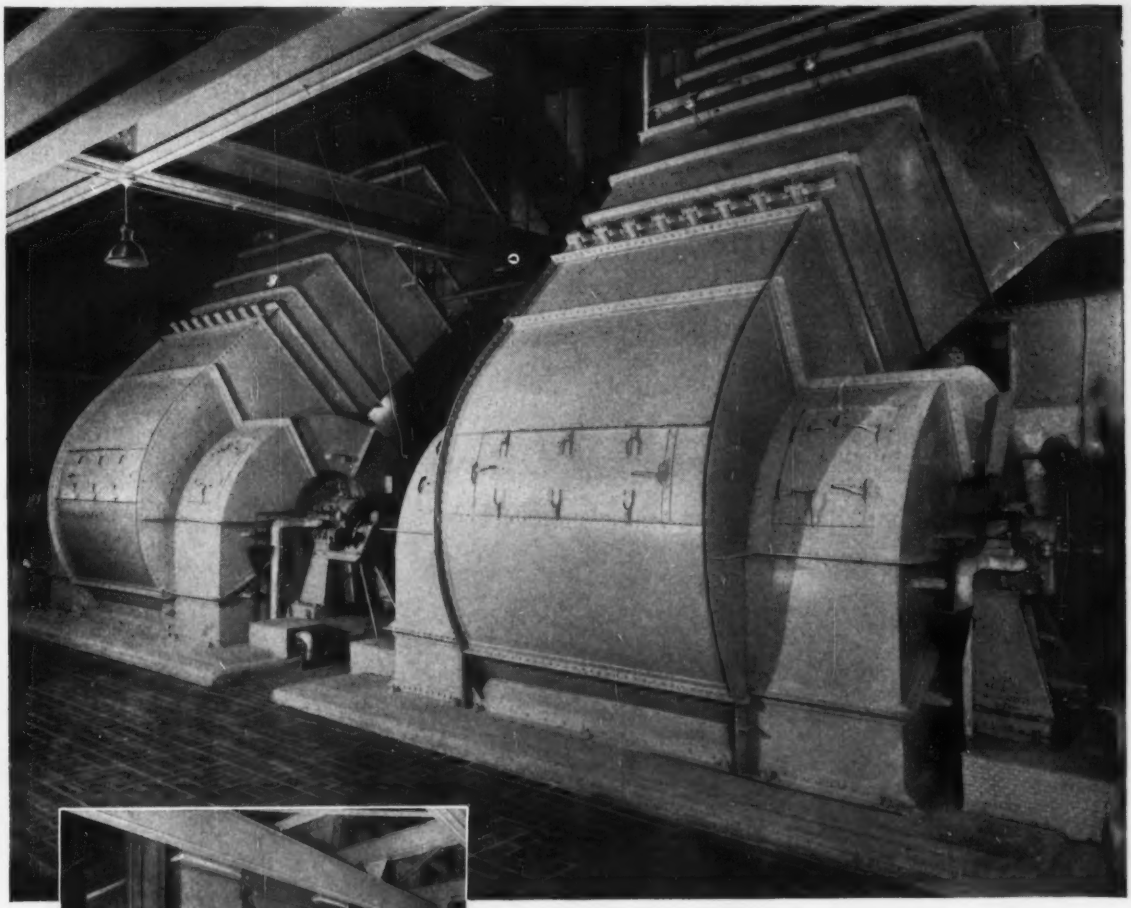
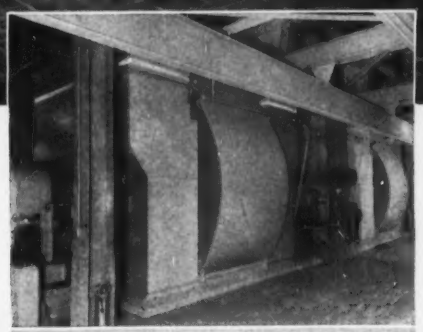




Top Photo: Two "Buffalo" Forced Draft Fans recently installed in a large Ohio Valley utility station. "Buffalo" outlet damper control.

Two "Buffalo" Induced Draft Fans in the same new power plant. These ruggedly built fans have both the endurance and high efficiency to provide the greatest draft economy.

another modern utility station using "Buffalo" fans

"Buffalo" Mechanical Draft Fans have always been the choice of leading utility stations, as well as industrial plants, because of their famous "Q" Factor* construction — the "Q" Factor of bonus strength, accessibility and outstanding efficiency. Their low maintenance costs and their economy of driving power combine to give the lowest possible draft costs. Thousands of "Buffalo" installations are proof of it.

And, to match the exact conditions under which you plan to operate, "Buffalo" offers you a complete choice of tested and proven blade designs — backward curve, our new deep-bite airfoil wheel, radial and forward curve blades.

Assure this important part of your power production—specify "Buffalo". Write for Bulletin 3750 or contact your nearby factory-trained "Buffalo" Engineering Representative.

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

BUFFALO FORGE COMPANY

BUFFALO, NEW YORK

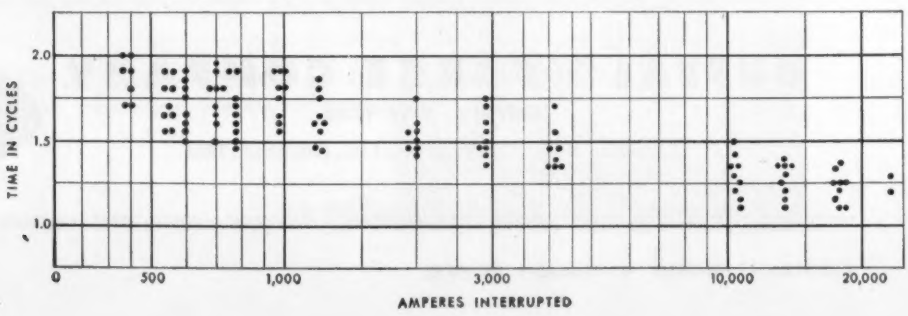
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

Proved again the fastest, most efficient principle of arc extinction ever devised . . . Above, the exclusive Westinghouse De-ion® arc interrupter in action. One of the features that makes possible the many advancements and leadership of Westinghouse-designed breakers.

Results of typical interrupting tests with the new 50-DHHS air breaker . . . several hundred interruptions, 500 to 30,000 amps, interrupted within two cycles.



Westinghouse paces industry needs with

fastest operating air breakers available

Your present and future needs in air circuit breakers are assured by recent Westinghouse developments. In a move to keep a jump ahead of utilities requirements in basic circuit protection, Westinghouse has developed a series of new ratings in air circuit breakers for use in metal-clad switchgear.

These metal-clad breakers cover important utility applications including 4-kv distribution circuits, large metropolitan substations and generating station auxiliary power needs.

New ratings have been added to the standard line of Westinghouse 5-cycle breakers. The breakers described below, featuring new interrupting ratings and times, have behind them the outstanding experience and reliability of Westinghouse plus exhaustive tests in our own high-power laboratories.

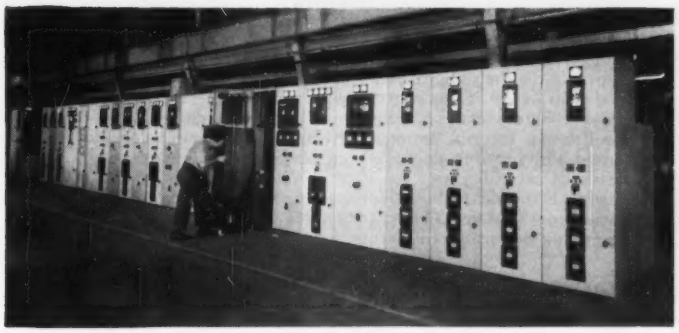
NEW 50-DH-75 BREAKER . . . Rated 75-mva interrupting capacity, 4.16 kv, 1200 amperes continuous, 5-cycle rated interrupting time.

NEW 150-DH-750 BREAKER . . . Rated 750-mva interrupting capacity, 13.8 kv, 1200 or 2000 amperes continuous, 5-cycle rated interrupting time.

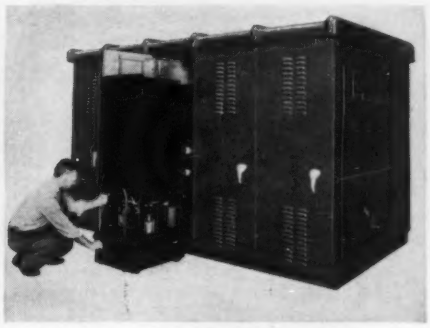
NEW 50-DHHS BREAKER . . . The new 2-cycle, high-speed breaker for 4.16-kv distribution circuits. Reduces wire burn downs and annealing. Rated 30,000 amperes interrupting capacity at 4.16 kv, 600 amperes continuous, 40,000 amperes momentary, 2-cycle rated interrupting time.

NEW 50-DH-350 BREAKER . . . Rated 3000 amperes continuous, 350-mva interrupting capacity, 4.16 kv, 5-cycle rated interrupting time. For heavy-current circuits.

Call your Westinghouse sales engineer or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60891-X



Standardized convenience . . . draw-out feature with this 50-DH-350 breaker, as with all Westinghouse air breakers, means quick, foolproof replacement, maximum accessibility.



150-DH-750 air breaker for outdoor metal-clad switchgear in a large metropolitan substation.

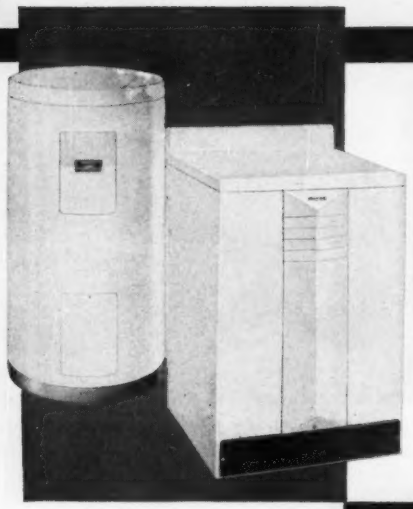
WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***

Hotpoint

Electric Water Heaters

With Performance and Features That Build Preferred Acceptance ... and Utility Revenue!



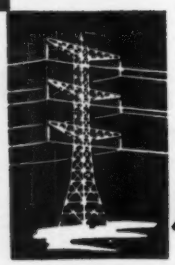
Almost *one-third* of the electric water heaters in use today were manufactured by Hotpoint—positive proof that Hotpoint has the acceptance that helps build *your* revenue!

Take advantage of this constantly growing preference. Promote Hotpoint Water Heaters . . . the *pre-sold* line that promotes acceptance through forceful national advertising . . . and helps *you* promote with a hard-hitting, *local* merchandising program designed specifically for utility use!

Learn all the facts about Hotpoint Automatic Electric Water Heaters from your local Hotpoint Distributor. He will be happy to help you build assured revenue for the future with Hotpoint.

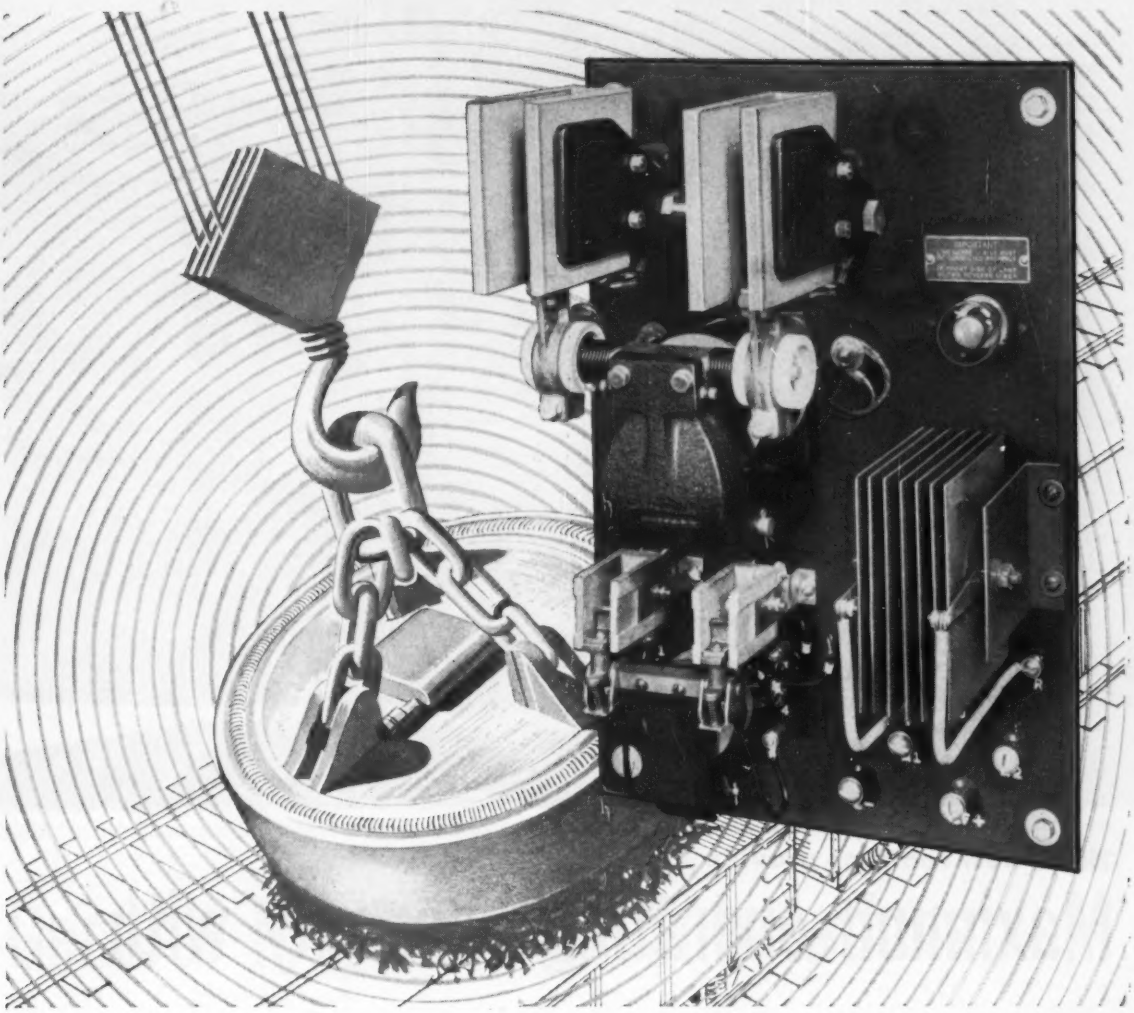
- **Hotpoint Water Heaters are available in a full range of sizes, in both round and table-top models.**
- **Famous Magic Circle® Heat—Calrod® heating units transmit heat to the water by conduction—the most direct and efficient method.**
- **New Colortones—table-top models come in 5 colors as well as white!**
- **New Super-Speed—40-gallon quick-recovery models ready for shipment.**

Again, Hotpoint



looks at Tomorrow, Today!

HOTPOINT CO. *(A Division of General Electric Company)* **5600 West Taylor Street, Chicago 44, Illinois**



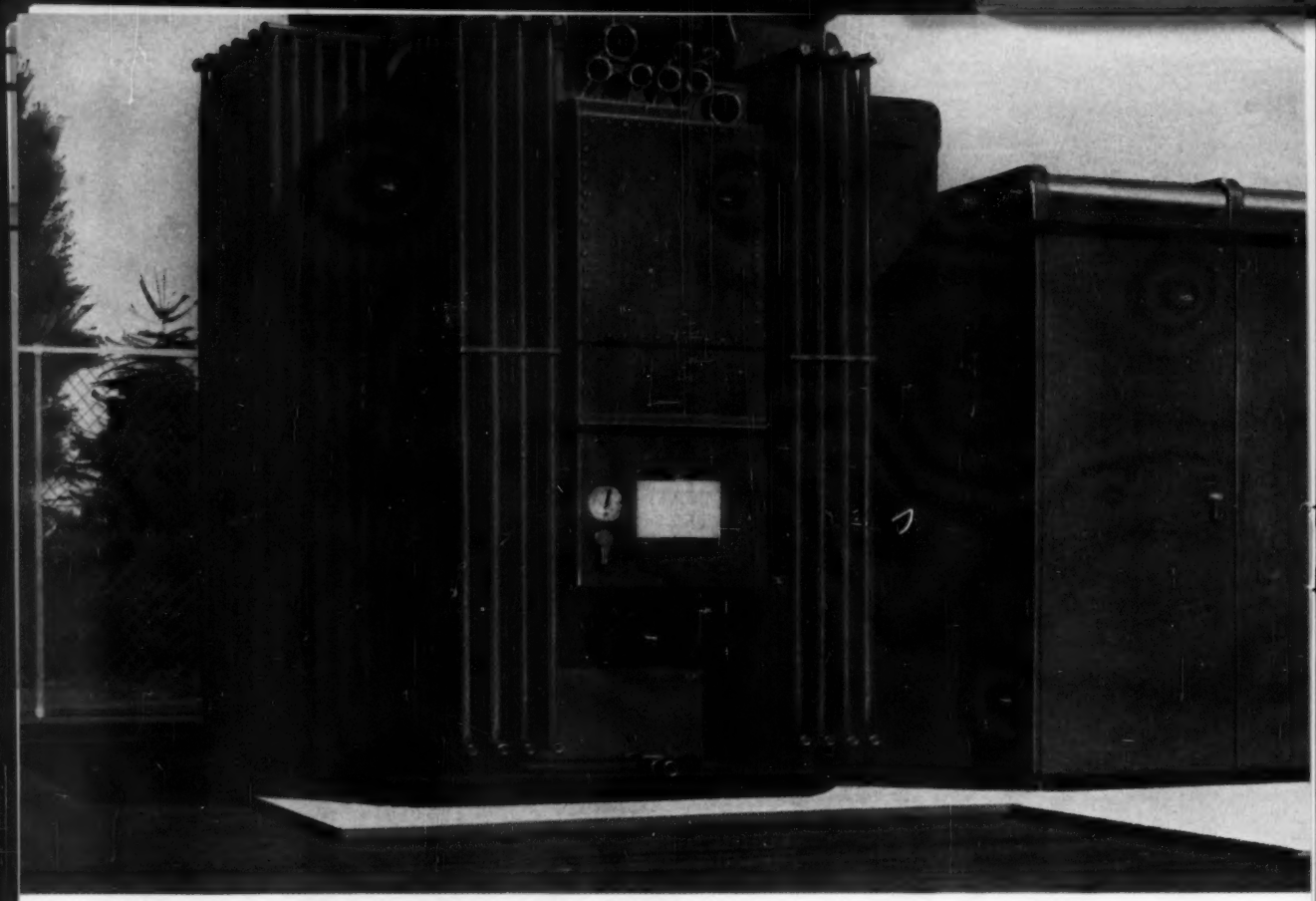
Ohio Electric Manufacturing Co. guards against arc damage *with J-M Ohmstone panels*

Ohio Electric Manufacturing Co. has long been known for the dependability and durability of their magnets. Exacting care is employed both in construction and selection of materials. Among these is Johns-Manville Ohmstone used as the panel board in the magnet control element. Especially designed and constructed for unusually dusty conditions, Ohmstone incorporates exceptional arc resistance and high dielectric strength.

Made of asbestos, cement and a water-repellent ingredient, Ohmstone is bonded under pressure and impregnated with a non-carbonizing insulating compound. It withstands shock and vibration . . . won't rust or rot . . . resists water, oil, gas, ordinary chemicals and sudden temperature changes.

Ohmstone can be machined and drilled to accommodate apparatus. For further information write to Johns-Manville, Box 14, New York 16, N.Y. In Canada: 565 Lakeshore Road East, Port Credit, Ontario.

Johns-Manville OHMSTONE® AN ASBESTOS PRODUCT

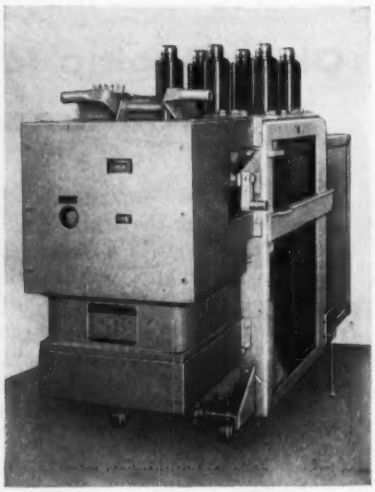


These new features provide . . .

Maximum operating economy with

NEW LOAD TAP CHANGER doubles predictable life of contact tips, cutting routine maintenance in half. Peak operating noise has been reduced by 20 db.

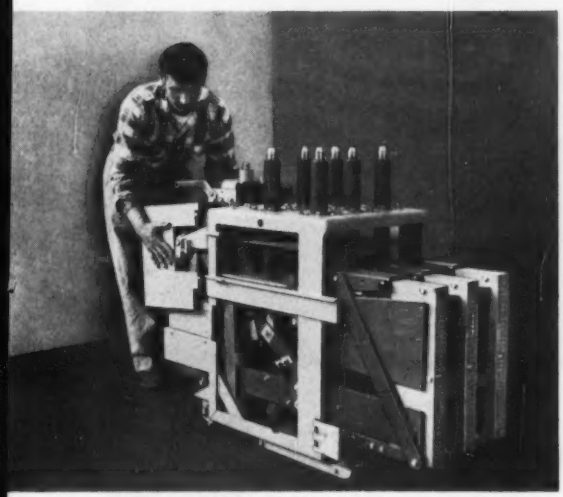
"CONTROL CENTER" groups all transformer indicators and most accessories in single control zone—makes them easier to read and service.



MAGNE-BLAST CIRCUIT BREAKER, now available in ratings up to 750 mva, offers maximum fire protection because of newly improved Self-X insulation.

SMALL SIZE, UNCLUTTERED APPEARANCE MAKES G-E UNIT SUBSTATION EASY TO LANDSCAPE, EASY TO INSTALL CLOSE TO LOAD.

General Electric Unit Substations



QUICK, EASY ACCESSIBILITY greatly facilitates breaker maintenance. Box barriers and operating mechanism cover can be removed in a minute and a half, completely exposing breaker's vital parts.

The features illustrated on these pages are the most recent quality improvements General Electric has built into its unit substations. They constitute a part of General Electric's continuing effort to provide the users of G-E unit substations with maximum operating performance and a minimum of maintenance. Because of this constant search for a better way, more and more utilities are installing G-E unit substations on their distribution lines as an economical means of handling rapid residential load growth.

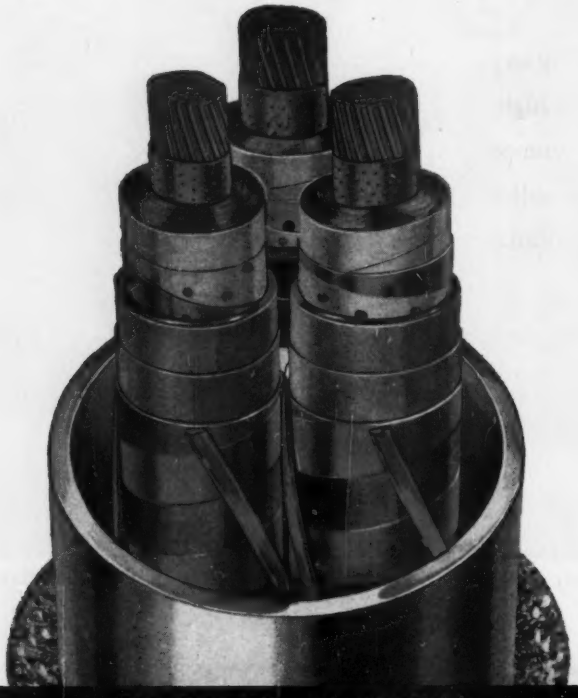
For more information about G-E unit substations, contact your G-E Apparatus Sales Office, or write for bulletin GEA-3800, to Section 512-13, General Electric Co., Schenectady 5, N. Y.

Progress Is Our Most Important Product

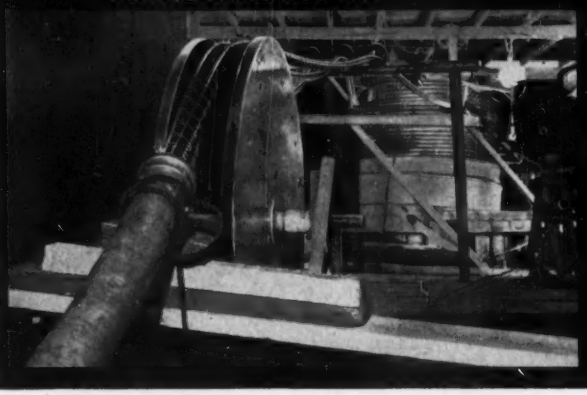
GENERAL ELECTRIC

Phelps Dodge

WIDEST RANGE OF HIGH



Pipe Type, Compression Cable, from 15 KV to 230 KV.

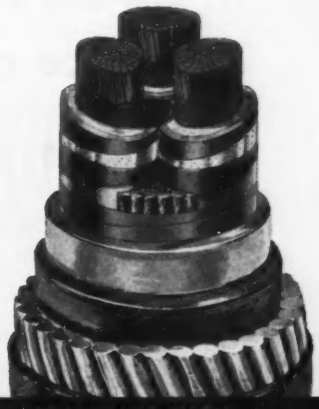


Low Pressure, Oil-Filled Cable, from 15 KV to 230 KV.

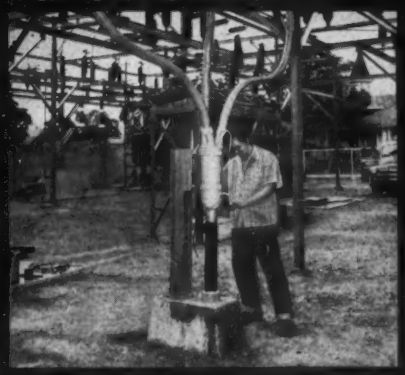
Consult Phelps Dodge for the correct answer to your requirements, regardless of voltage or type!

offers Industry's VOLTAGE POWER CABLE!

Only Phelps Dodge has manufacturing experience and operational "know how" with the entire range of high voltage cables which includes: oil compression, gas compression, high pressure oil, high pressure gas, pipe type cables; medium pressure gas, low pressure oil-filled, low pressure gas, submarine and solid type cables.



Low Pressure, Gas-Filled Cable, from 15 KV to 44 KV.



Submarine Cable, from 15* KV to 35 KV.

Solid Type Cable, from 15* KV to 69 KV.

*Lower voltage cables in this class also available.

PHELPS DODGE COPPER PRODUCTS CORPORATION

300 PARK AVENUE, NEW YORK 22, N. Y.

Now! *Reliable*

ALL-ALUMINUM SQUEEZ® SLEEVES

in all service entrance combinations

ALUMINUM - ACSR - COPPER from SIZES No. 10 to No. 2

These heavy-wall, all-aluminum *SQUEEZ* Sleeves are cleaned, greased and capped, ready for use. The colored plastic caps that code the sizes need not be removed, they are punctured by conductors. The solid center barrier locates and separates conductors and assures an even distribution of the factory added grease to all strands within the sleeves.

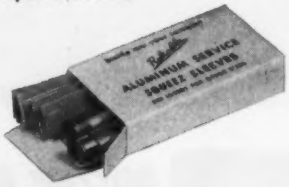
Fifteen sleeves, color coded and marked provide for all conductors No. 10 to No. 2.

RELIABLE NO. 10-XPJ *SQUEEZ* TOOL

For maximum versatility with minimum truck and working space, the Reliable No. 10-XPJ combines three standard die grooves in a toggle type tool.

Handles are coated with bright orange vinyl plastisol that provides insulation when used for work on secondaries. Also available with painted handles. Bright color helps avoid loss.

FREE SAMPLES Just ask for your free samples of Reliable Aluminum *SQUEEZ* Sleeves . . . they'll be sent promptly.



Reliable ELECTRIC COMPANY CHICAGO 12, ILLINOIS

POWER LINE CONNECTORS AND CONSTRUCTION SPECIALTIES

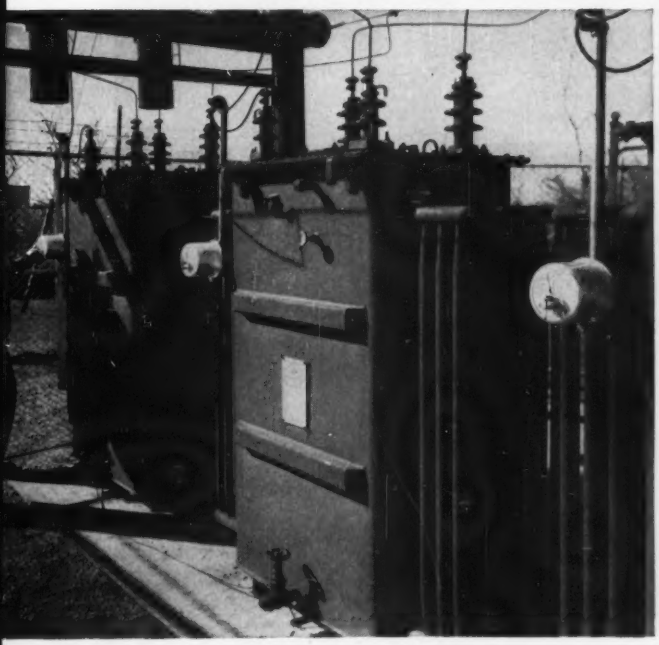
A V2JS VOLTMETER-WATTHOUR METER COMBINATION permanently installed at first or last customer from the transformer. Regular meter reader reports minimum and maximum voltage to Engineering Department.

COMPLETE TEST SET checks load and voltage at customer's premises —gives full information on circuit conditions at input to customer service, while continuing to record KWH consumption.

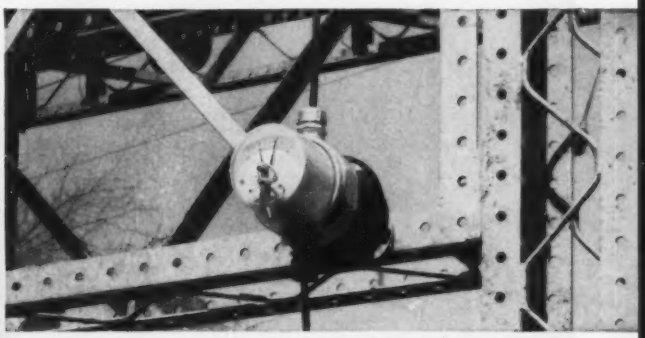
for better knowledge of your system ...use Lincoln Meters!

Indicating meters provide the low-cost way of obtaining complete knowledge of your system. They give continuous data of load, balance, and current values—on transformers, on feeders, at substations, at system check points. Lincoln Indicating Meters are simple in design and operation—flexible in application. Use the coupon below for detailed information on these economical aids to system betterment.

SANGAMO ELECTRIC COMPANY, Springfield, Illinois



LINCOLN ADN AMPERE DEMAND METERS, tied solidly in to the neutral, provide continuous knowledge of load and balance on 4WY banks of transformers. No instrument transformers are required.



THIS "HOT" TYPE AD-5 LINCOLN METER indicates amperes and gives balance on primary feeder circuits. Meter is insulated from ground with a post-type insulator and is arranged for hot stick reset.

SANGAMO ELECTRIC COMPANY, Springfield, Illinois

Please send me the information checked below:

- ☐ Information on Lincoln Voltmeters and Ammeters.
- ☐ Bulletin on Test Sockets.
- ☐ Booklet: "Solving Distribution Problems through Measurement."

NAME_____

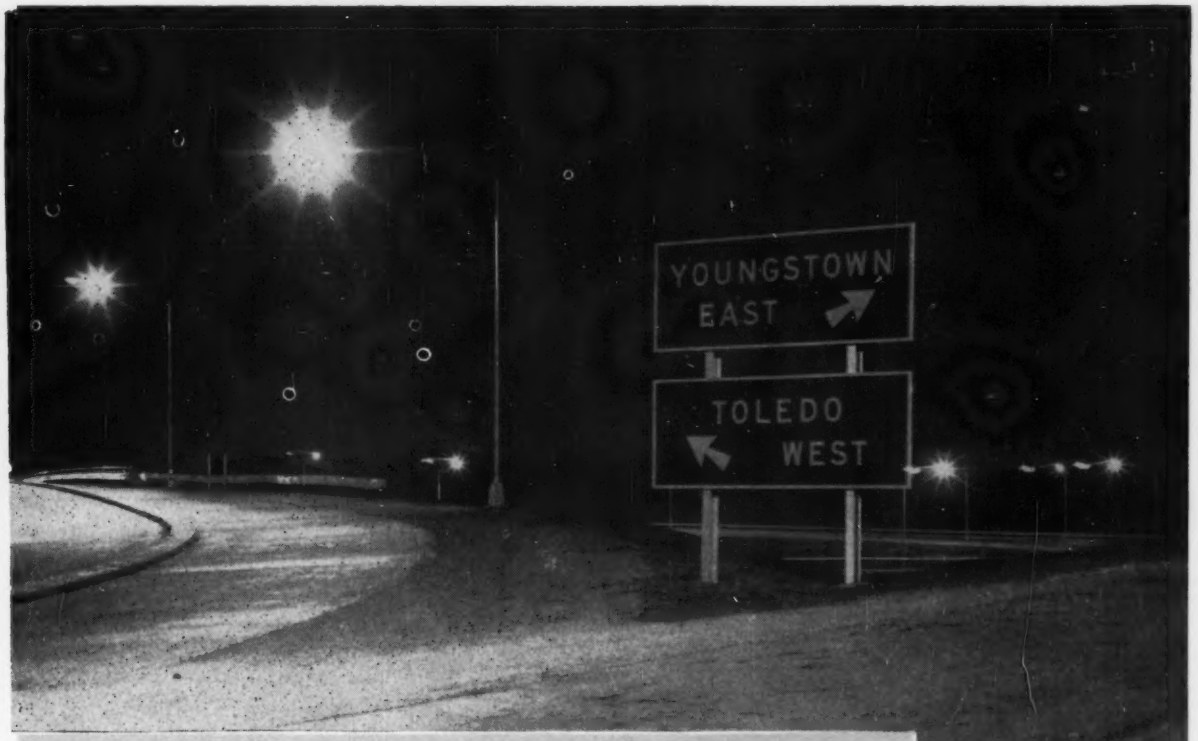
COMPANY_____

ADDRESS_____

CITY_____ STATE_____

SM56-6

HERE'S the way to



light a turnpike!

The new Ohio Turnpike, spanning the state from Pennsylvania to Indiana, is a model of modern highway construction. And one of the outstanding features of this road is the lighting of the interchanges.

What an immense job it was to build this 241-mile road! Enough dirt was excavated to fill a two-lane tunnel 268 miles long. They dumped enough fill to cover 500 football fields to a depth of 28 feet. Carefully the bogs were drained, slides were stopped and the rock was blasted to make the great road possible.

Skillful engineering is apparent along every foot of the Turnpike—and this includes the selection of vital materials used to build it. Buried in the ground near the interchanges you'll find over half a million feet of Tiger Brand 3,000-volt internal shielded cable serving as main feeders. Many thousands of feet of Tiger Brand RR cable serve as bracket cable in the poles, and an additional quarter million feet of Tiger Brand cable grounds the entire system.

When you install Tiger Brand cable, you have gone a long way toward insuring a trouble-free wiring system.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

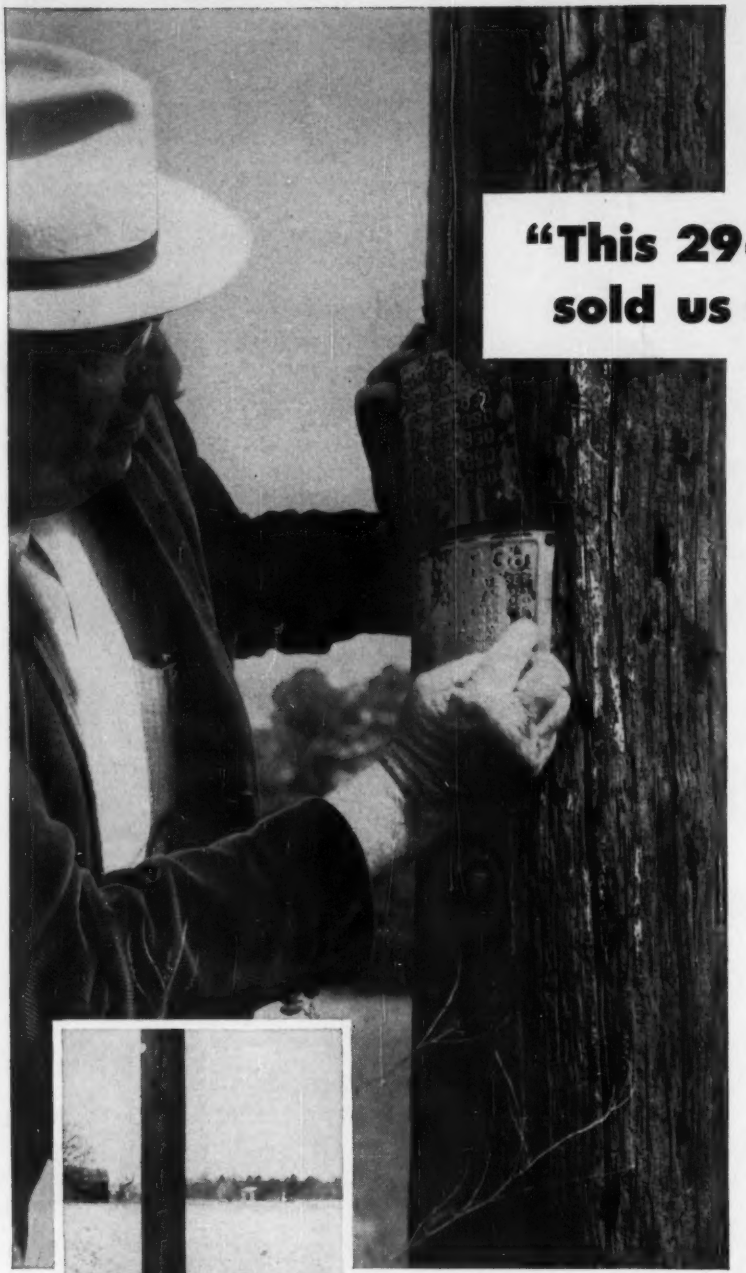
USS TIGER BRAND ELECTRICAL WIRE & CABLE

A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB

- machine tool and building wire
- special purpose wire and cable
- asbestos wire and cable
- paper and varnished cambric cable
- aerial, underground and submarine cable
- shovel and dredge cable
- mold cured portable cord

USS

UNITED STATES STEEL



"This 29-year-old pole sold us on creosote!"

says District Manager of Georgia Power Company

Power and light consumption in the State of Georgia is growing by leaps and bounds. From 1935 to 1955, it jumped from 11,833,000,000 kilowatt hours to 126,313,000,000 kilowatt hours.

Naturally, poles are playing an important part in this growth. In the Jonesboro District, for example, poles are being added at the approximate rate of 500 per year. And they are all pressure-creosoted. 29-year-old poles like the one shown here have sold the Georgia Power Company on creosote as a preservative. In the words of J. A. Garner, District Manager, "We just don't think about using anything but pressure-creosoted poles anymore."

This is just one example of how power companies are benefiting from the long service life of pressure-creosoted poles and crossarms. For more data on pressure-treatment and USS Creosote—the quality preservative — write United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.; or call the nearest United States Steel Chemical Sales Office.

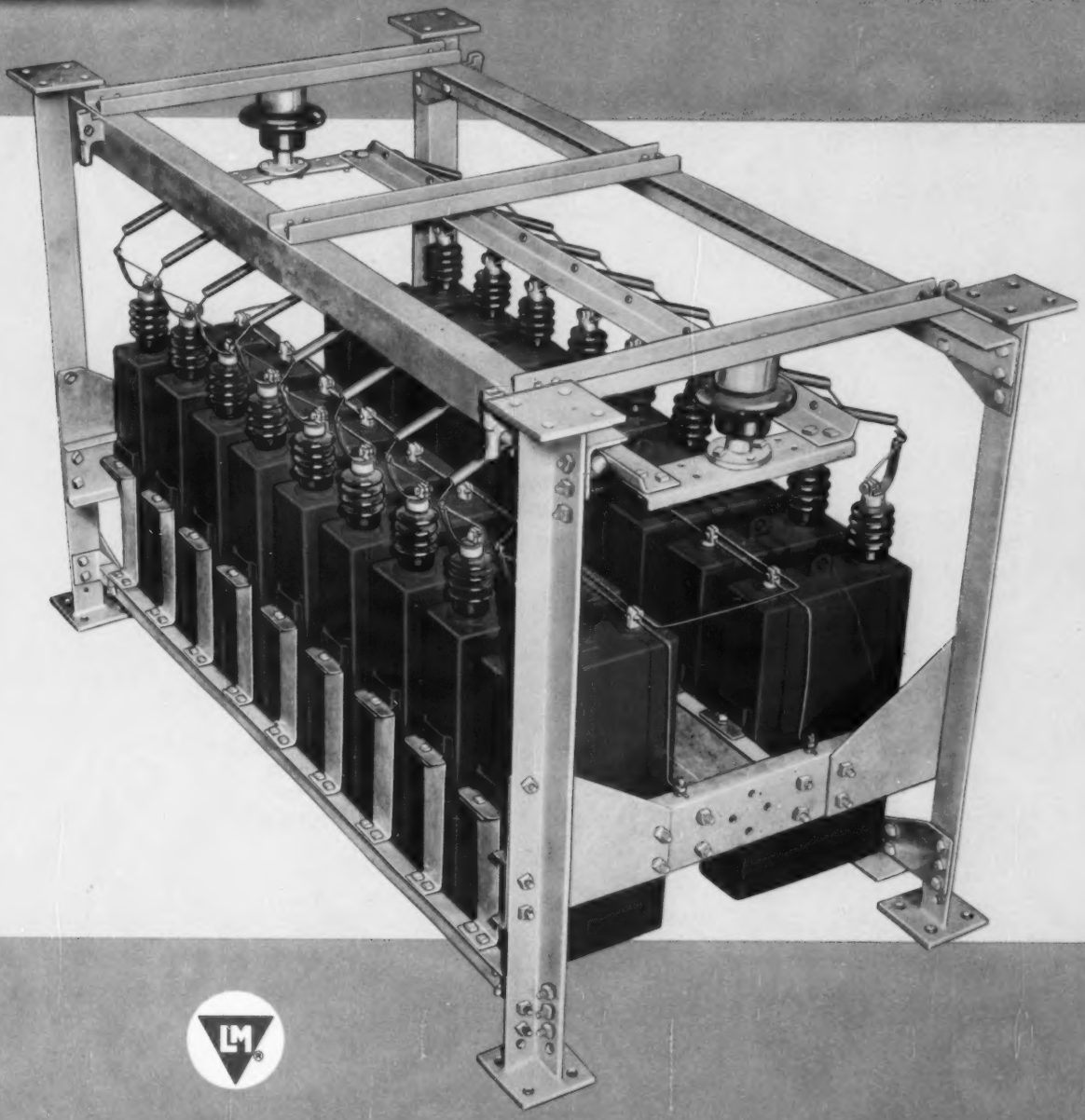
J. A. Garner, District Manager of the Georgia Power Company, examines a 29-year-old pressure-creosoted pole. His comment: "Looks like it will last indefinitely." Inset shows new line installed near Jonesboro, Georgia in 1955. All 500 poles in this line are pressure-creosoted.

USS CREOSOTE

SALES OFFICES IN PITTSBURGH, NEW YORK, CHICAGO, CLEVELAND, SALT LAKE CITY AND FAIRFIELD, ALA.

USS

UNITED STATES STEEL



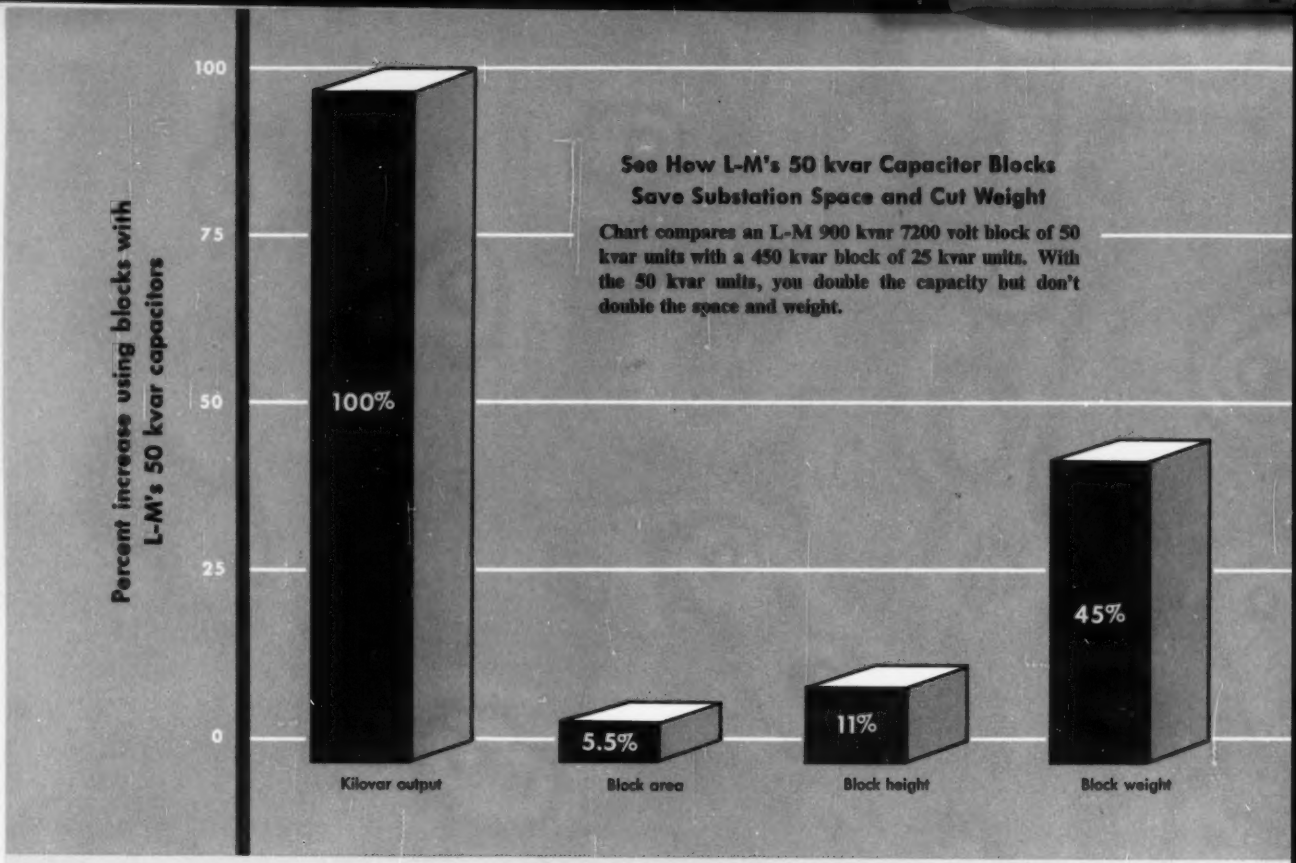
L-M's New 50 Kvar Capacitor Blocks

Save Space, Cut Costs

LINE MATERIAL *Elemex® Capacitors*

A McGRAW ELECTRIC COMPANY DIVISION

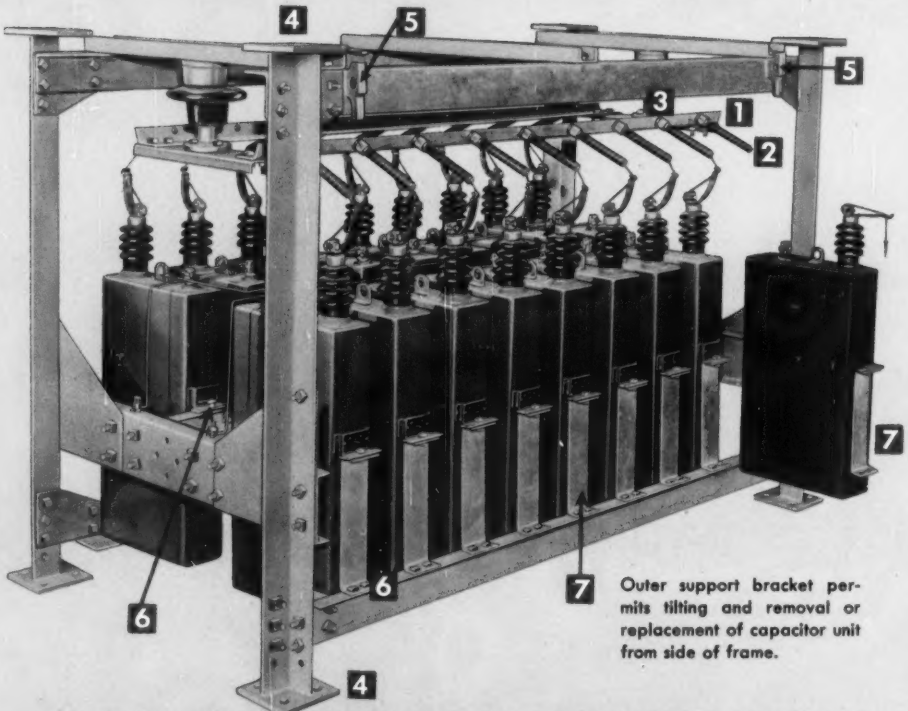
see details ▶



See How L-M's 50 kvar Capacitor Blocks Save Substation Space and Cut Weight

Chart compares an L-M 900 kvar 7200 volt block of 50 kvar units with a 450 kvar block of 25 kvar units. With the 50 kvar units, you double the capacity but don't double the space and weight.

1. Aluminum-alloy bus
2. Bus-mounted fuses
3. Bus connections wire brushed and treated with oxidation inhibitor.
4. Jig-assembled for perfect alignment of mounting pad bolt holes.
5. Lifting lugs.
6. Tapped holes in frame for capacitor mounting bolts. Nuts not needed.

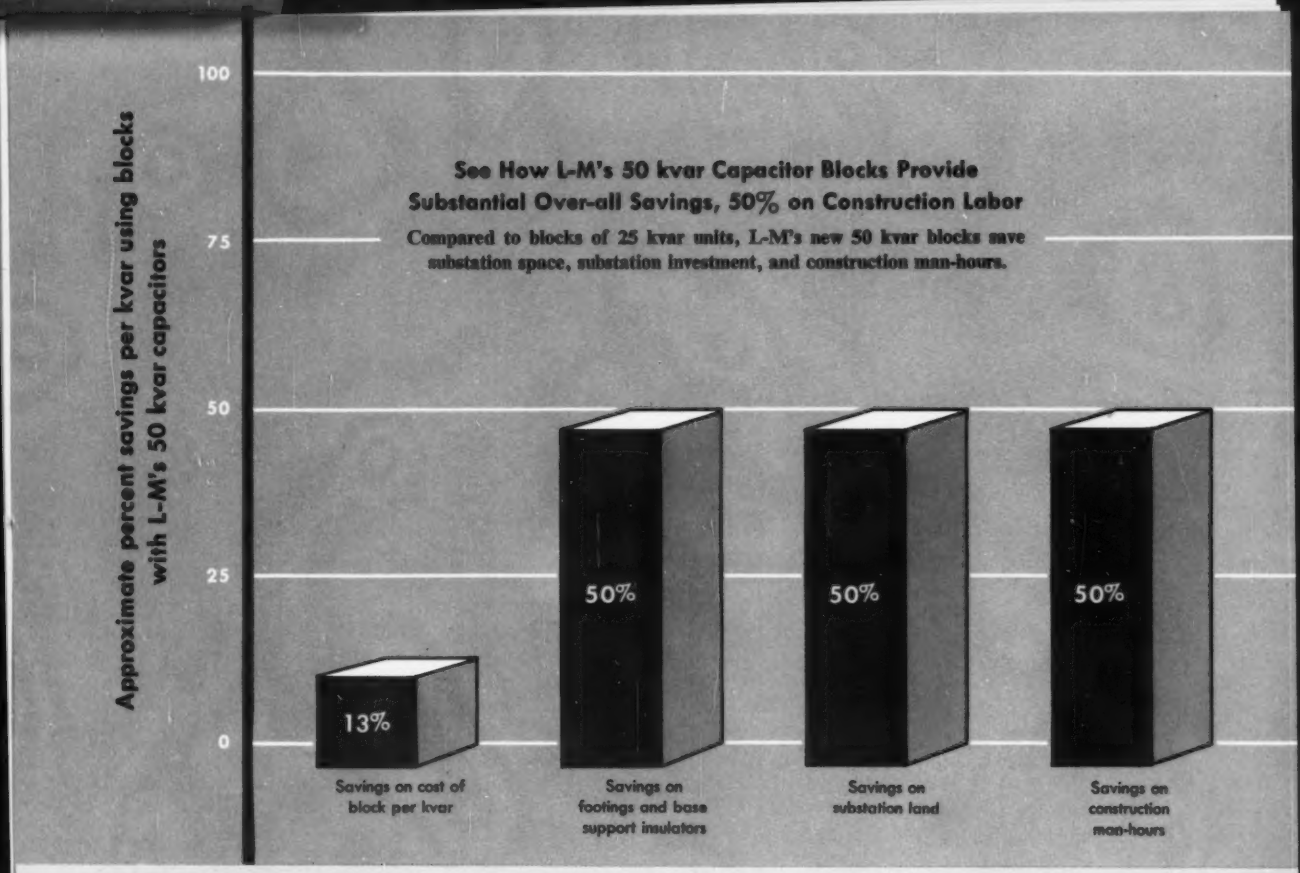


Outer support bracket permits tilting and removal or replacement of capacitor unit from side of frame.

L-M's new 50 kvar factory-assembled block has approximately the same area as a 25 kvar block with the same number of units and it is only 5 inches higher. Capacitors in L-M's 50 kvar blocks can be removed and replaced by simply tilting and sliding the capacitor from the side of the block. It is not necessary to lift the capacitor out from between the mounting members.

LINE MATERIAL

A McGRAW ELECTRIC COMPANY DIVISION


See How L-M's 50 kvar Capacitor Blocks Provide
Substantial Over-all Savings, 50% on Construction Labor
Compared to blocks of 25 kvar units, L-M's new 50 kvar blocks save substation space, substation investment, and construction man-hours.
Approximate percent savings per kvar using blocks with L-M's 50 kvar capacitors
100
75
50
25
0
13%
50%
50%
50%
Savings on cost of block per kvar
Savings on footings and base support insulators
Savings on substation land
Savings on construction man-hours

Another L-M First...

L-M's New 50 Kvar Capacitor Blocks Provide Kilovars At Still Lower Costs

By **BLAINE SCHULTZ**
Chief Engineer
Capacitors and Regulators
Line Material Company

Only half as many units are required in substation capacitor banks when you use L-M's new blocks of 50 kvar capacitors. In addition, these blocks reduce the number of fuses, footings, and base support insulators, as well as the construction man-hours required for any given-size bank. L-M 50 kvar preassembled capacitor blocks also cost less and require about 50% of the substation area per kvar in comparison with blocks containing 25 kvar capacitors.

Capacitor Unit

The internal construction of L-M's 50 kvar capacitor is identical with that of the 25 kvar unit except for the length of pack. There is no increase in voltage stress to get the higher kvar rating. The new design is the result of continued improvement in dielectric materials and manufacturing techniques.

The tank has the same width, same thickness as the 25 kvar capacitor. Only 10 inches of additional height give you twice the capacity. It also has aluminum-metallized coating under alkyd resin paint; paragroove clamp-type terminals; strong solder-sealed bushings; and low-temperature Elemex liquid dielectric.

Factory-Assembled Blocks

L-M offers a complete line of NEMA Standard 50 kvar factory-assembled blocks from 2400 through 7960 volts—400 to 1200 kvar ratings in 100 kvar increments.

Outstanding features of L-M factory-assembled blocks include:

- Aluminum-alloy bus which is not subject to cold flow.
- Bus-mounted capacitor fuses with stainless-steel flipper to eject the leader if fuse link ever blows. Leader cannot hit live parts.
- Connections to the bus are wire brushed, and treated with oxidation inhibitor.
- Height of block is increased only 5 inches, because it is so designed that capacitors can be installed and removed from the *side*. It is not necessary to provide clearance to lift the capacitor out from between the mounting members.
- Heavy galvanized frame is jig-assembled for perfect alignment of mounting-pad bolt holes.

Prompt Delivery Now

You can save on the cost of equipment, man-hours, and space in the substation when you specify L-M NEMA Standard 50 kvar capacitor equipments. Prompt delivery now on all sizes and voltage ratings. Ask your L-M Field Engineer for complete information on L-M's new 50 kvar factory-assembled capacitor equipments. Or write Line Material Company, Milwaukee 1, Wis.

Elemex® Capacitors

more ▶

L-M Offers Application Engineering Service

L-M's service includes design of protective and control schemes for single- and multi-step banks, and complete capacitor equipments.

Line Material development engineers are experienced in the design and application of any size or type of capacitor bank for operation at transmission or distribution voltages. L-M will supply information on protective and control schemes, and will cooperate with utility company engineers to assure the best capacitor bank designs.

Single- or Multi-Step Switching

Careful consideration is given to both electrical and economic factors in the selection of single- or multi-step capacitor banks. These factors include fault-current and over-voltage relationships, number of units in parallel for any series group, step-switching sequences, grounded or ungrounded neutrals, and capacitor switch limitations.

Protective Schemes

L-M development engineers will recommend link sizes for fusing individual units and for capacitor bank group fusing; also current, voltage and time-delay relay schemes and alarm circuits as required.

Control Schemes

L-M will design voltage, current, time, kilovar, or temperature sensitive control schemes or any combination to best fit your system.

L-M engineers will cooperate with you in working out the most satisfactory capacitor application designs.

Other Line Material Capacitor Equipments

L-M's complete line of capacitor equipments includes pole-mounted 25- and 50-kvar capacitor racks—pole-mounted secondary capacitors—submersible secondary capacitors.

All Line Material capacitors incorporate outstanding product features such as aluminum metallic coating under a primer and finish coat of alkyd resin paint, strong solder-sealed bushings, and low-temperature Elemex liquid dielectric.

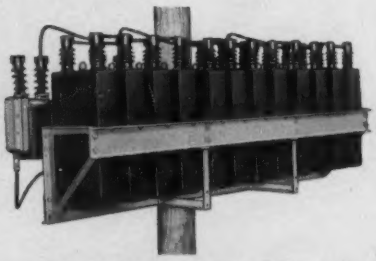
25 and 50 kvar Capacitor Racks

L-M's pole-mounted capacitor racks are factory-assembled and wired, ready to install on distribution systems rated 2400 to 13,800 volts. New 50 kvar racks are available up to 450 kvar switched and 600 kvar unswitched multi-row racks; up to 600 kvar switched or unswitched single-row racks.

New 50 kvar racks have less weight and require less space on the pole per kvar compared to 25 kvar racks. A 600 kvar 7200 volt switched single-row rack weighs only 31% more than a 300 kvar rack with 25 kvar units.

Pole-Mounted Secondary Capacitors

L-M's 240 volt secondary capacitors are available in 3, 5, and 7½ kvar. The units are small, light, and rugged; easy to install on crossarm or direct pole mounting. Shipping carton permits inspection and testing without removing capacitors from the carton.



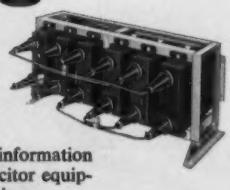
L-M's new 50 kvar capacitors in 600 kvar switched pre-wired pole-mounted rack.

Submersible Secondary Capacitors

L-M's new 216 volt, 13⅓ kvar submersible capacitors are available in 40, 80, and 120 kvar racks, entirely assembled at the factory and ready for installation. Racks are designed for a minimum space requirement and can be passed through a 30-inch diameter manhole.

3, 5, and 7½ kvar 240 volt secondary capacitors. 10 kvar units will be available soon.

Height 13¾" 3 kvar
18¾" 5 kvar
23½" 7½ kvar

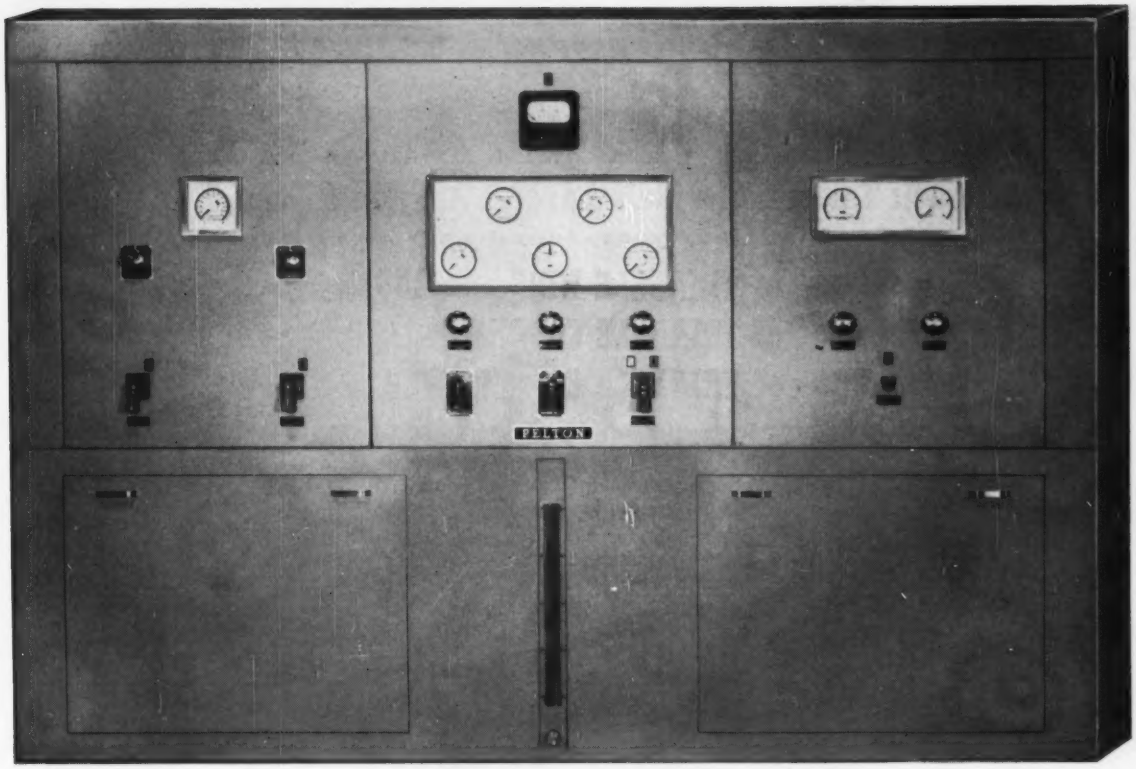


80 kvar submersible secondary capacitor equipment

Get More Information—Ask your L-M Field Engineer for information on features, design and delivery on L-M's complete line of capacitor equipments. Or write Line Material Company, Milwaukee 1, Wisconsin.

LINE MATERIAL *Elemex®* **Capacitors**

A McGRAW ELECTRIC COMPANY DIVISION

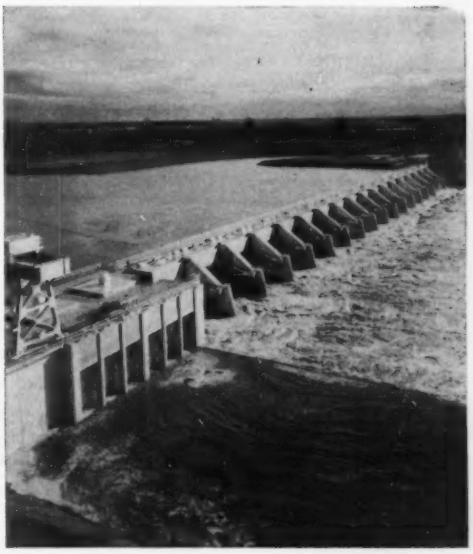


Designed for Nimbus Dam on the American River, California, this Pelton governor has a wicketgate capacity of 126,000 ft.-lbs. and a Kaplan blade capacity of 87,500 ft.-lbs.

Pelton® governor for Nimbus power plant exceeds contract specifications

Prior to installation at Nimbus Dam, this Pelton governor was exhaustively tested under simulated power plant conditions. It was tested under load changes, frequency deviation and variations in speed droop. These notarized tests proved that sensitivity of the speed response element, and over-all governor characteristics will *more* than meet the job.

Pelton pre-tested performance is an integral part of every Pelton product. In addition to governors, BLH manufactures all four basic types of turbines, valves, pumps, surge suppressors and related equipment. For illustrated bulletins, write BLH Corporation, Philadelphia 42, Pennsylvania, or Dept. 5407, Pelton Division (BLH), 2929 Nineteenth Street, San Francisco 10, California.



BALDWIN BLH LIMA-HAMILTON

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Another **TRIANGLE** *multiple product Job*

PALM BEACH

Palm Beach Towers. Florida's Largest Apartment Hotel

...designed for luxurious year-round apartment living:

1,100,000′ of TRIANGLE WIRE and CABLE
169,000′ of TRIANGLE CONDUIT
52,000′ of TRIANGLE COPPER TUBE

Luxury *demands* Quality. That's why Triangle conduit, wire, cable and copper tube were specified for the job.

Triangle is famous for the finest quality building products that research and modern equipment can produce.

Triangle products are nationally distributed—representatives are located in principal cities in the United States. For your next installation, you'll find it pays to call Triangle!

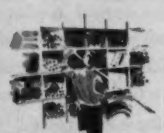
Palm Beach Towers, scheduled for opening December 1, 1956, is completely air conditioned, with restaurants and specialty shops provided to make it one of America's finest resort hotels.

ARCHITECT: John Hans Graham
GENERAL CONTRACTOR: The Taylor Construction Co.
ELECTRICAL CONTRACTOR: Interstate Electrical Co.
PLUMBING CONTRACTOR: Clarence Coston

let's take a quick look at **TRIANGLE**

Up to date research

Ever expanding plants



Large stocks in redistribution centers

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It Must Be Right
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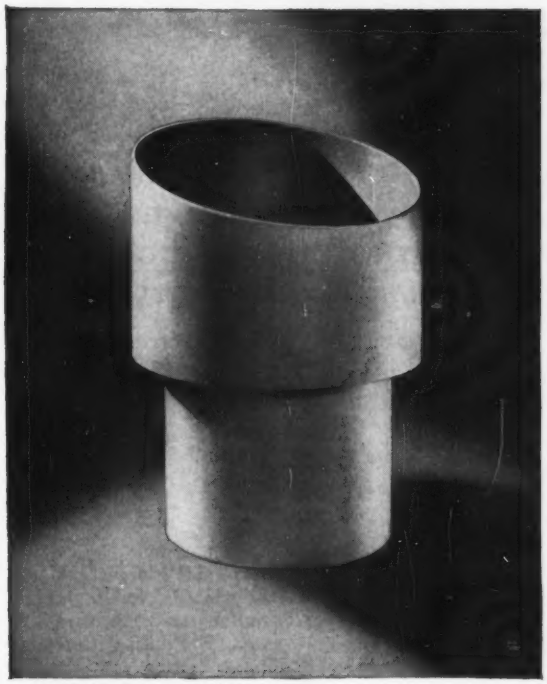
Conduit and Cable Co., Inc.

NEW BRUNSWICK, NEW JERSEY



C-D-F HANDLES THE COMPLETE JOB An oil circuit breaker component is made from two Dilecto laminated plastic tubes, with a threaded ring joining the assembly. From raw materials to finish machining C-D-F does it all!

Utilities can depend on equipment containing C-D-F Insulating Parts

The reliable operation and long life of heavy electrical equipment often depends on insulating parts. A good supplier of insulation draws from past experience to make this possible—C-D-F has been a recognized industry leader since 1895! A good supplier expands his research and technical skill consistently—C-D-F offers the *widest range of electrical insulating materials*, from Vulcanized Fibre to C-D-F Products of Teflon.*

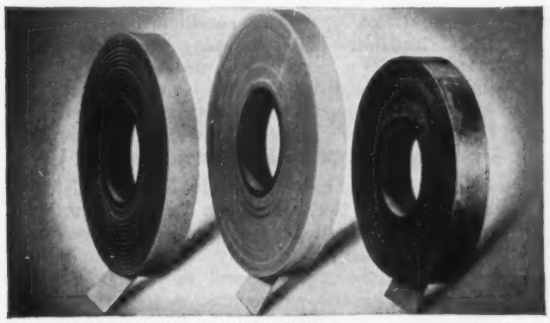
A BIG, RELIABLE SOURCE OF SUPPLY

As a buyer of Utility Electrical Equipment, you gain when your manufacturers work with C-D-F. Quality and dependability of electrical insulation, at reasonable cost, are guaranteed. The latest technical advances and ideas can flow freely between you and C-D-F's engineers. This page shows only a few of the many products C-D-F makes and fabricates for the electrical industry. Consult Sweet's Design File for catalog information, or call your C-D-F sales engineer (sales offices in principal cities)—you'll find he's a good man to know!

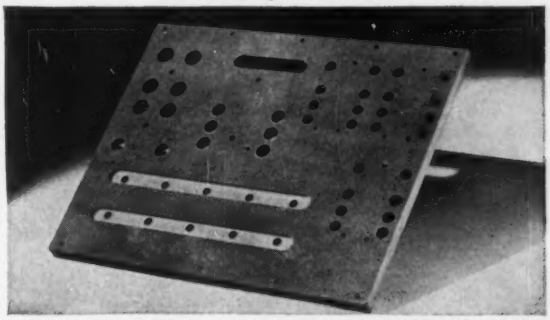
*Du Pont Trademark

CONTINENTAL DIAMOND FIBRE

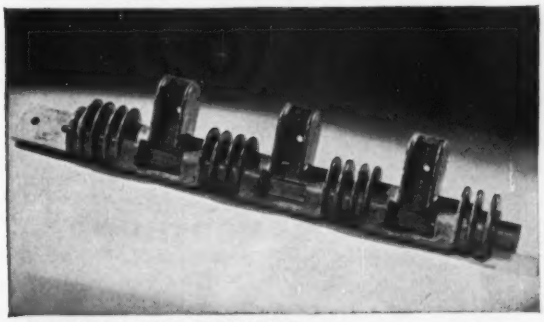
CONTINENTAL-DIAMOND FIBRE DIVISION OF THE BUDD COMPANY, INC.
NEWARK 15, DELAWARE



C-D-F MAKES FLEXIBLE INSULATION To meet critical high heat and electrical insulating needs, C-D-F makes these efficient, easy-to-apply tapes. Size range is wide, with latest resins and backing materials used. Write for samples and technical bulletins of Silicone, Teflon, and Micabond tapes.

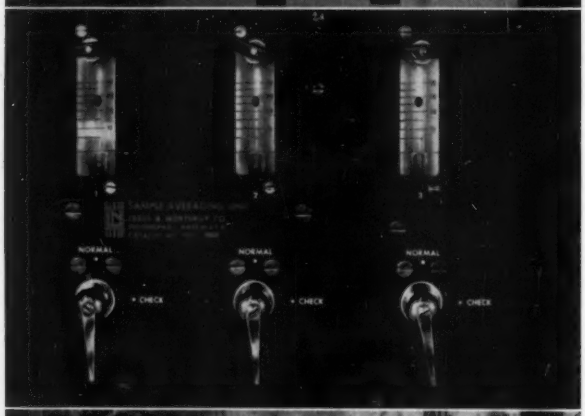


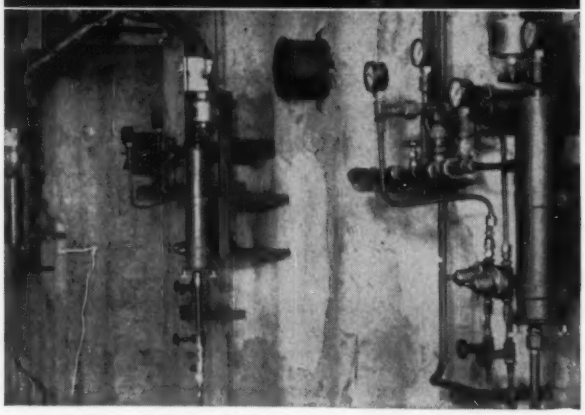
C-D-F UNDERSTANDS THE ELECTRICAL INDUSTRY'S NEEDS Precisely machined to close tolerances, Dilecto panel boards guarantee dependable insulation, help designers save space. New 1955 Dilecto catalog is yours for the asking, lists all new grades.



C-D-F MOLDS MANY SPECIALTIES This shaft insulator for a circuit breaker is molded from C-D-F's cloth-based industrial thermosetting plastic, Celoron. Note complexity of mold, clean detailing. Celoron has high impact strength, is used in switchgear.

C-D-F GIVES YOU BETTER MOTOR AND GENERATOR INSULATION All these built-up and bonded mica products are made by C-D-F to provide uniform high-heat resistance and dielectric strength. All forms of Micabond are made for better performance and lower costs.





THE NEW SPEEDOMAX O_2 SYSTEM GIVES A CONTINUOUSLY ACCURATE COMBUSTION PICTURE...

Here's why!

■ Already, on some of the country's largest boilers, this new Speedomax O_2 System is enabling operators to trim excess air automatically to maintain combustion efficiency . . . and to do it with a certainty never before possible.

Why? As one operator put it, "The System gives me a record that's meaningful. When I look at this O_2 chart I know what's *really* happening—and I know it right away."

Behind this operator's confidence is the new L&N Multiple-Probe Sample Averaging Unit which *assures a more representative sample.* This unit maintains a true average from two, three, or more probes—even if individual sample flows drop 60 per cent. And excess air distribution across the duct can be checked right at the Averaging Unit.

There is also a new Reverse Jet Probe and Steam Sampler which delivers a *clean pressurized sample* even with the *dirtiest* of flue gases. Water jets flush the probe passage continually, steam ejector action pressurizes the sample, and steam condensing action plus centrifugal separation remove all dirt and acid.

And, in analyzing and recording, the speed of response of the Speedomax Recorder, coupled with the efficient operation of the L&N Magnetic O_2 Analyzer, increases speed and accuracy of O_2 analysis and recording even further.

Why not learn more about this new Speedomax O_2 equipment and what it can do for you? Write to Leeds & Northrup Company, 4938 Stenton Ave., Philadelphia 44, Pa.

LEEDS N NORTHRUP
instruments *automatic controls* • *furnaces*

Wire sculpture by Henry Szafarz

The Inside Story

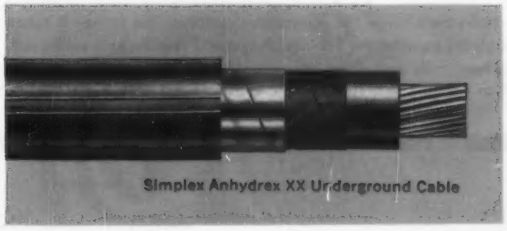
Beneath the surface, there's a lot going on.

An underground river of power surges through innumerable cables, supplying the electrical energy that keeps the entire community rolling smoothly.

Throughout the nation, Simplex products are used extensively in such applications. This is particularly true of ANHYDREX XX, the ideal all-purpose cable for high-voltage use. This expertly engineered cable is popularly employed in the 2001 to 35,000 volt range, and has a Conductor Temperature Rating of 90°C up to 5 KV (a rating never attained before the development of ANHYDREX XX).

For more technical data, write for Booklet 1023.

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.



Simplex Anhydrex XX Underground Cable

Simplex

NEW UTILITY STATIONS, C-E EQUIPPED

Includes only *new* stations on *new* sites placed in operation since JANUARY 1, 1950.

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MORRO BAY
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JOHN SEVIER
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MILLIKEN

GALLATIN

NEW GALLATIN

The Tennessee Valley Authority's newest and, in some respects, most notable steam power station was added to the T.V.A. system recently when the first of two duplicate 250,000 KW units was placed in service. The second unit is scheduled for early in 1957. Design of the station contemplates an ultimate plant of ten units.

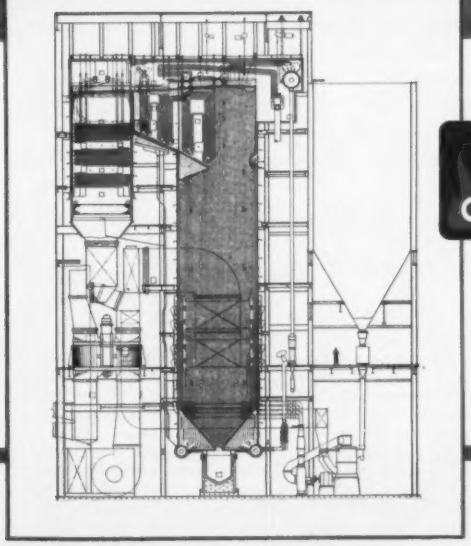
Located on the Cumberland River waterway 20 miles northeast of Nashville, the Gallatin Station will help meet the rapidly growing power demand—for farm and home use and particularly for national security requirements and expanding industrial development—in the T.V.A. area. The two-unit project involves much associated construction such as some 17 miles of permanent rail trackage, a 6-mile access road, and 2250 feet of tunnels through solid rock. In addition, the Corps of Engineers is developing a 9-foot-draft channel on the Cumberland.

Each of Gallatin's two turbogenerators is served by a C-E Controlled Circulation Steam Generating Unit. Both units are connected to a single 500-foot stack. These boilers are each capable of delivering 1,650,000 lbs. of steam per hour. A brief description and a cross-sectional elevation of the C-E boiler serving Unit No. 1 appear below and on the opposite page.

Shown at the right is one of the two duplicate C-E units going into service at the Gallatin Station. Each is designed to serve a 250,000-kw turbine-generator operating at a throttle pressure of 2000 psi with a primary steam temperature of 1053 F, reheated to 1053 F. They are of the controlled circulation, radiant type with a separated furnace arrangement. Secondary superheater surface is at the outlet of one furnace and reheater surface at the outlet of the other. Primary superheater sections and economizer surface follow both the secondary superheater and reheater surfaces. Regenerative air heaters follow the economizer surfaces. The section is taken through the superheater furnace. Pulverized coal firing is employed, using bowl mills and tilting, tangential burners. Natural gas may be used as an alternate fuel.

STEAM PLANT

Goes into Service



C-E

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Combustion Engineering Building
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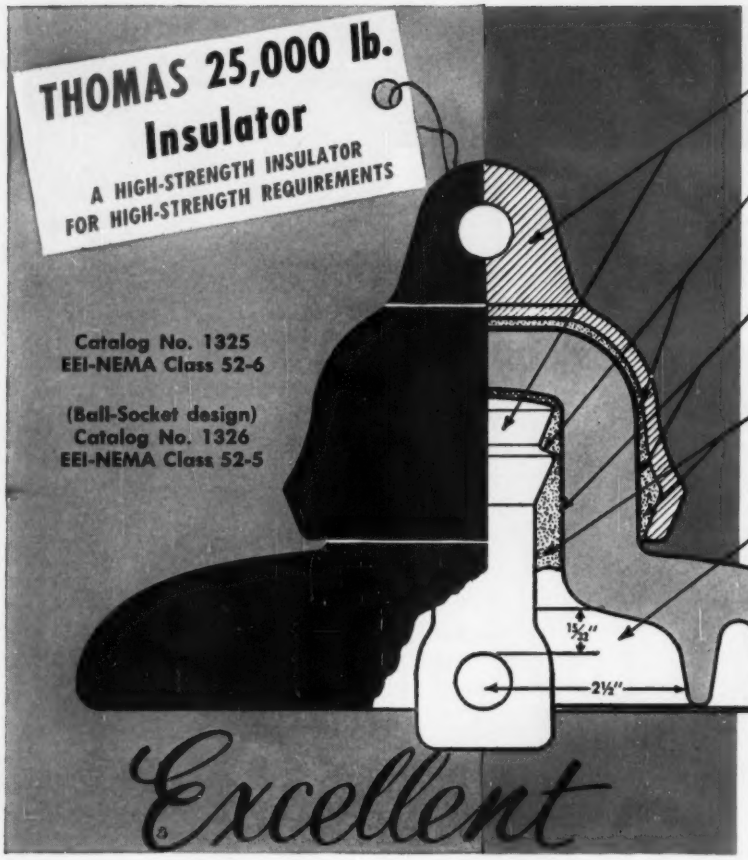
STEAM GENERATING UNITS; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; HOME HEATING AND COOLING UNITS; DOMESTIC WATER HEATERS; SOIL PIPE B-947


THOMAS 25,000 lb.
Insulator
A HIGH-STRENGTH INSULATOR
FOR HIGH-STRENGTH REQUIREMENTS
Catalog No. 1325
EEI-NEMA Class 52-6
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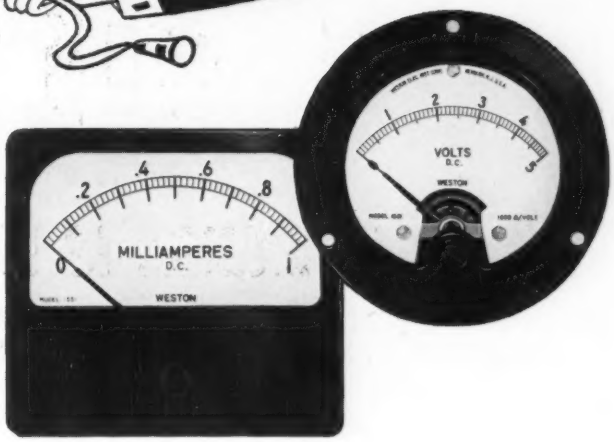

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A BARSTROW UNIT

WESTON INSTRUMENTS

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ANACONDA IS READY WITH THE BROADEST LINE IN THE INDUSTRY

At Anaconda, only the metal is different—service and quality are the same, whether you specify copper or aluminum.

So let Anaconda meet your aluminum needs with...

1 Broadest line of aluminum conductors in the industry including bare aluminum and ACSR; Neoline*, Polene* and Duraline* line wire; Types SE, SD, N-SD and K service cables; aerial power cable; network cable; cathodic protection cable; and many others.

2 Seven-mill service. Anaconda has more mills producing aluminum wire and cable than any other manufacturer. Seven fabricating mills strategically located across the country assure speedy service.

3 Electrical Distributors. Anaconda Wire & Cable Company has several hundred electrical distributors located throughout the country who can expeditiously provide you with Anaconda products.

4 Reduction plant at Columbia Falls, Montana, gives Anaconda control over its aluminum production from reduction of alumina... to wirebar... to rod... to finished product.

5 Insulated-cable experience—in design, research, construction and quality control—helps Anaconda produce aluminum wire and cable with superior electrical and physical characteristics.

6 Technical assistance. Anaconda field engineers have worked in advisory capacity on hundreds of complex jobs. They are ready to put their experience and knowledge to work on your problem.

The Man from Anaconda will be happy to help you. Backed by the broadest line of wire and cable in the industry in both copper and aluminum, he is best qualified to help you arrive at the most practical and economical answer to your cable needs. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

*Reg. U. S. Pat. Off. 56304

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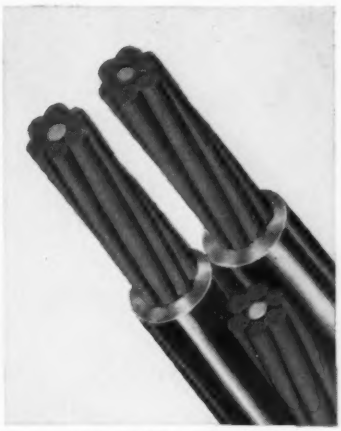
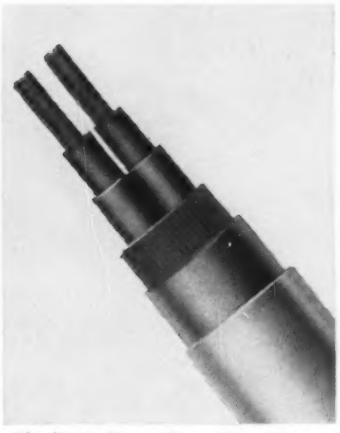


Type N-SD service drop

Type K service drop



Silvaline* Type SE service entrance

Duraline weatherproof line wire

Neoline* and polyethylene line wire

Aerial cable

Type CP cathodic protection cable

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FOR ALUMINUM WIRE AND CABLE

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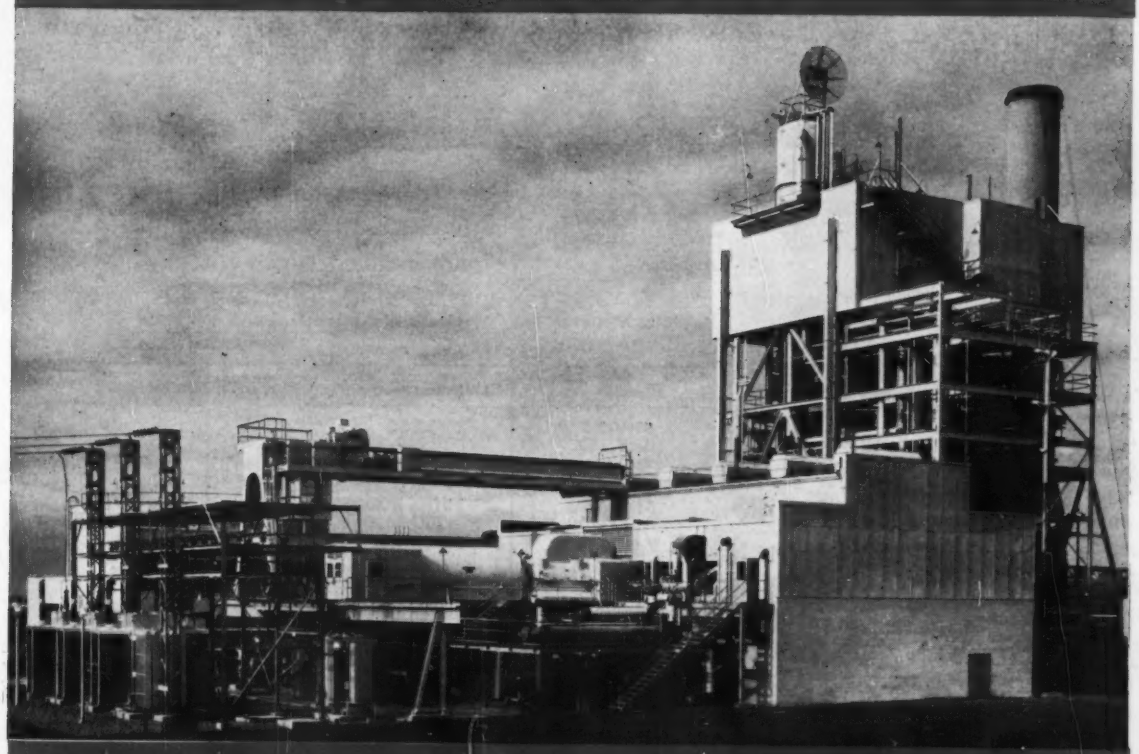
POWER AHEAD OF NEED

The new Humboldt Bay Steam Plant marks another forward step for Pacific Gas and Electric Company. It is part of an expansion program which is tripling the company's capacity, providing an abundance of low cost electrical power vital to Northern California's growth and prosperity.

The plant incorporates the latest advances in design and operation. Its 50,000 kilowatts of steam-generated electric power — and an additional capacity of 50,000 kilowatts in a second unit now under construction — supplement power from the interconnected P.G.&E. system which serves Northern and Central California.

With the close cooperation of P.G.&E. engineers, the plant was designed and constructed by Bechtel. *It illustrates an outdoor plant in a size range suited to the needs of many areas — a type of project in which Bechtel is keenly interested.*



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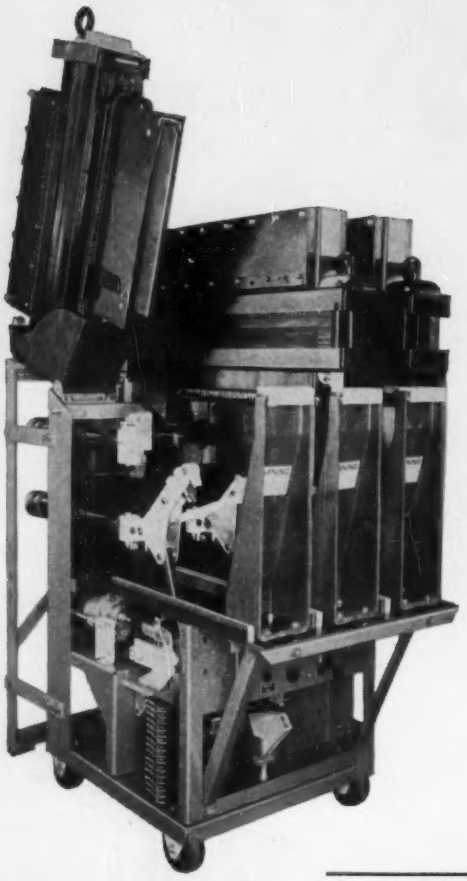


A Complete Line of I-T-E Metal-Clad Circuit Breakers for Every Application

Anticipating the proposed addition of three new higher metal-clad switchgear ratings, I-T-E now has a complete line of circuit breakers which are fully developed and tested to meet every requirement.

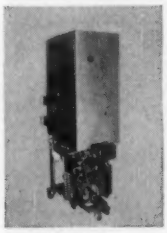
New 75 mva interrupting rating for I-T-E metal-clad switchgear applied on 4.16 kv systems

New 350 mva interrupting rating with a new 3000 amp continuous rating for application on 2.3 or 4.16 kv systems

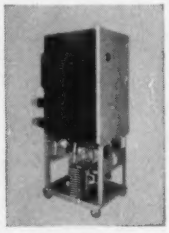
New 750 mva interrupting rating for application on 13.8 kv systems at 1200/2000 amp continuous

I-T-E Type	Continuous Amperes	Rated KV	Interrupting MVA
5HV-75	**1200**	4.16	**75**
5HV-150	600-1200-2000	4.16	150
5HV-250	1200-2000	4.16	250
5HV-350	**1200-3000**	4.16	**350**
7.5HV-250	1200-2000	7.2	250
7.5HV-500	1200-2000	7.2	500
15HV-150	600-1200	13.8	150
15HV-250	1200-2000	13.8	250
15HV-500	1200-2000	13.8	500
15HV-750	**1200-2000**	13.8	**750**

Note: These ratings require no change in I-T-E compartment dimensions.



5HV-75



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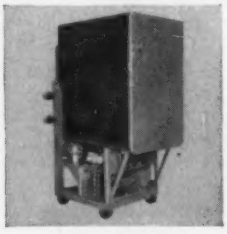
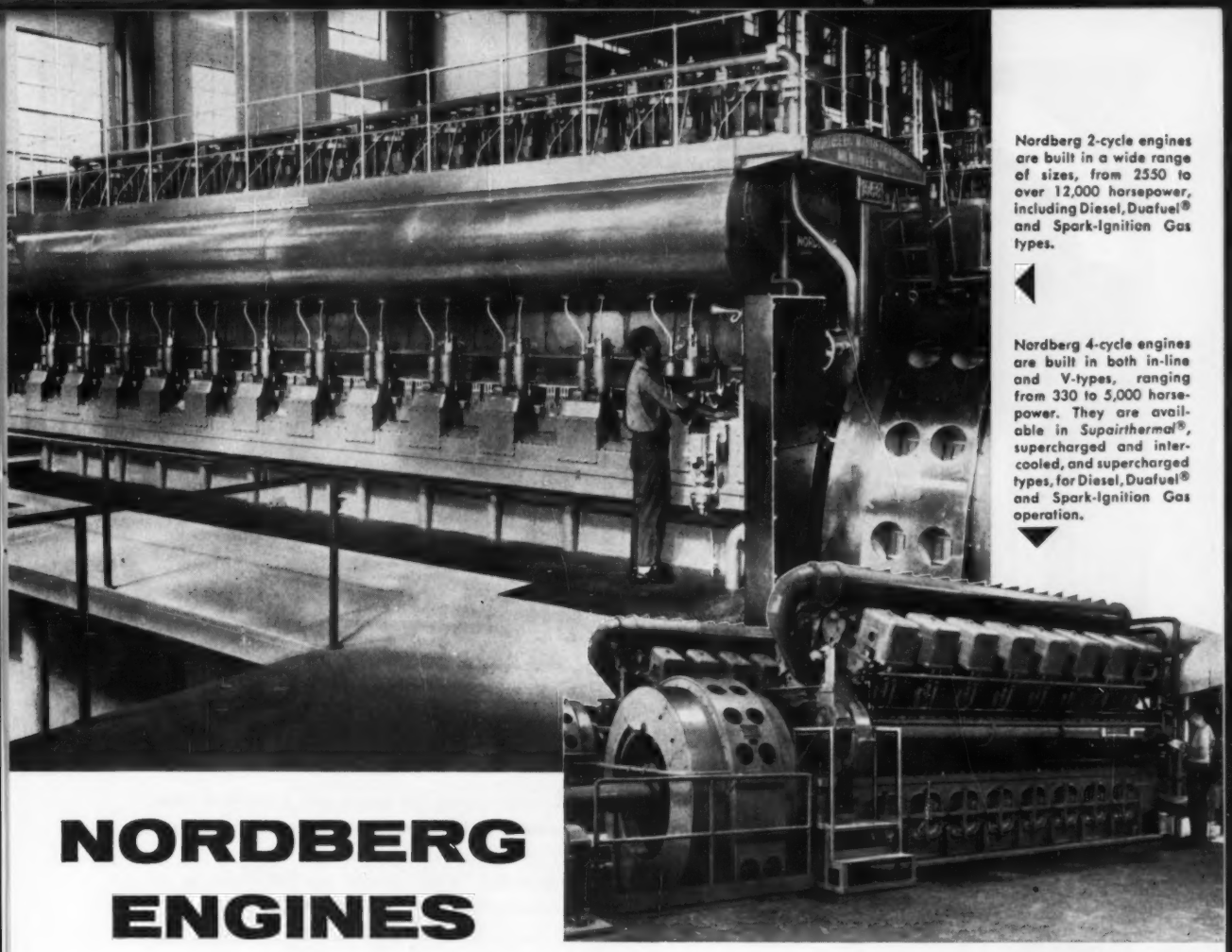


15HV-750

For complete information, call your nearest I-T-E sales office. Or write I-T-E Circuit Breaker Company, 19th & Hamilton Streets, Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division



Nordberg 2-cycle engines are built in a wide range of sizes, from 2550 to over 12,000 horsepower, including Diesel, Duafuel® and Spark-Ignition Gas types.

Nordberg 4-cycle engines are built in both in-line and V-types, ranging from 330 to 5,000 horsepower. They are available in *Supairthermal®*, supercharged and intercooled, and supercharged types, for Diesel, Duafuel® and Spark-Ignition Gas operation.

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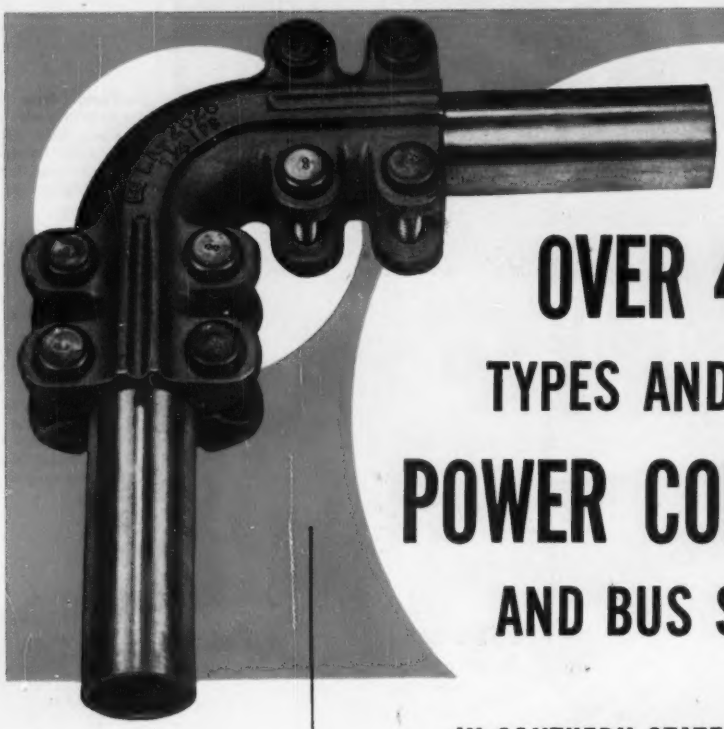
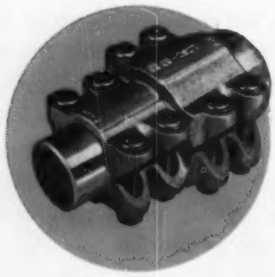


OVER 4,000
TYPES AND SIZES OF
POWER CONNECTORS
AND BUS SUPPORTS



IN SOUTHERN STATES' COMPLETE LINE

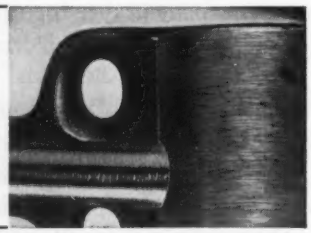
To meet the widest range of requirements for power and grounding connectors, Southern States produces more than 4,000 different types and sizes—many on special order to customers' specifications.

Widespread use of self-supporting, rigid, tubular bus constructions in substations has increased the mechanical requirements of many connectors. That is why Southern States connectors have been re-designed during the past two years. They now have stronger ears and are 40 to 50% heavier.

When you specify and use Southern States connectors, you can be sure they are capable of: 1) serving as self-supporting members; 2) providing good electrical connection; 3) developing full strength of clamping bolts without visible distortion; 4) carrying current equal to the conductor without excessive temperature rise; 5) being installed with a minimum of effort and time.

Rough Ground for Best Possible Contact

Every Southern States connector is rough ground on all contact surfaces. This permits the connector to bite into the conductor, causing intimate metal to metal engagement at thousands of high-pressure contact points, thus providing a better junction and one that is sealed against corroding atmosphere.



SOUTHERN STATES EQUIPMENT CORP.
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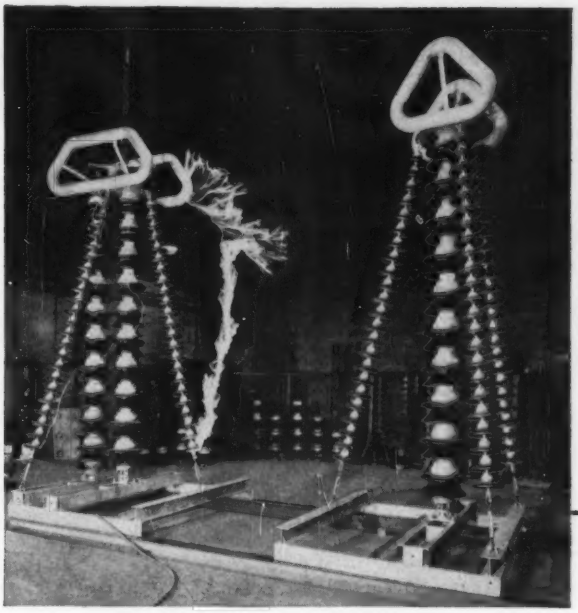
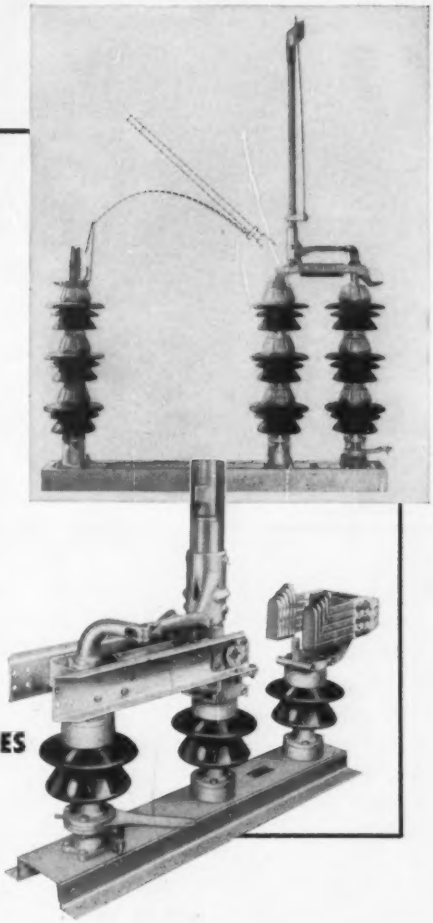
IN CANADA: Dominion Cutout Co., Ltd., Toronto



R&IE

SWITCH DEVELOPMENT AND RESEARCH

LOOKS HIGHER AND HIGHER SOLVING THE PROBLEMS OF TOMORROW



• HIGHER VOLTAGES

Over the High Voltage Horizon are the new operating characteristics of tomorrow's switch. Many factors associated with 400 Kv., or 500 Kv., such as insulation, break distance, corona shielding, R. I. V., all weather operation, and general refinement are constantly being investigated.

• HIGHER INTERRUPTING CAPACITIES

An increasing variety of air switch attachments are continually being perfected to increase the usefulness of air switches. The "Arc Restrictor" shown is one of several types for interrupting line charging current. Others for interrupting full-load current, isolating capacitor banks or for switching parallel loads, are available.

• HIGHER CURRENTS AND MOMENTARIES

Increased short circuits and higher fault currents are more important than ever before. The new straight-line current path design of Hi-Pressure Contact Jaws and Sealed Pressure Hinge Contacts is the answer to these problems.

R&IE Research and Development constantly evaluates the many possible design problem solutions to improve switching performance on the nation's expanding power lines. The new and larger R&IE laboratory facilities will give you a better guarantee of good performance and improved quality switching equipment.

•

R&IE EQUIPMENT DIVISION

I-T-E Circuit Breaker Co.

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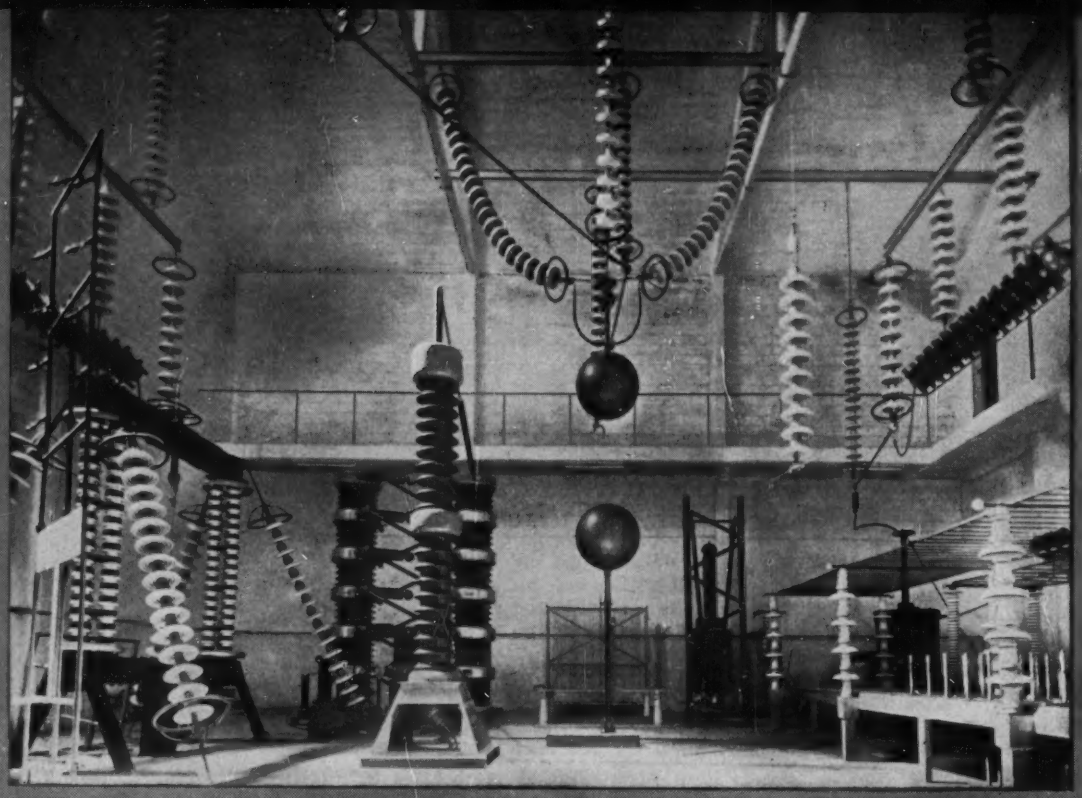
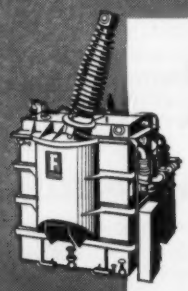
FERRANTI

HIGH VOLTAGE TESTING EQUIPMENT



ARGENTINA

A 1,000,000 volt Ferranti Impulse Generator installed in the Laboratories of Fabrica de Porcelana Armanino, Buenos Aires, Argentina.
This equipment produced the first ever 1,000,000 volt arc in Argentina. Ferranti have also supplied to the same customer a 500,000 volt, 250 kVA, A.C. Testing Equipment.



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The Ferranti transformer plant at Hollinwood, Lancashire, England, covering an area of over 300,000 sq. ft. has a manufacturing capacity per annum of over 5,000,000 kVA of Large Power Transformers, Distribution Transformers, Voltage Regulators, High Voltage A.C., D.C., and Impulse Testing Plant and Specialised Equipment. Contracts include the supply of transformers for the Garrison Dam and McNary Dam Projects in the U.S.A. and the Alcan Project in Canada.

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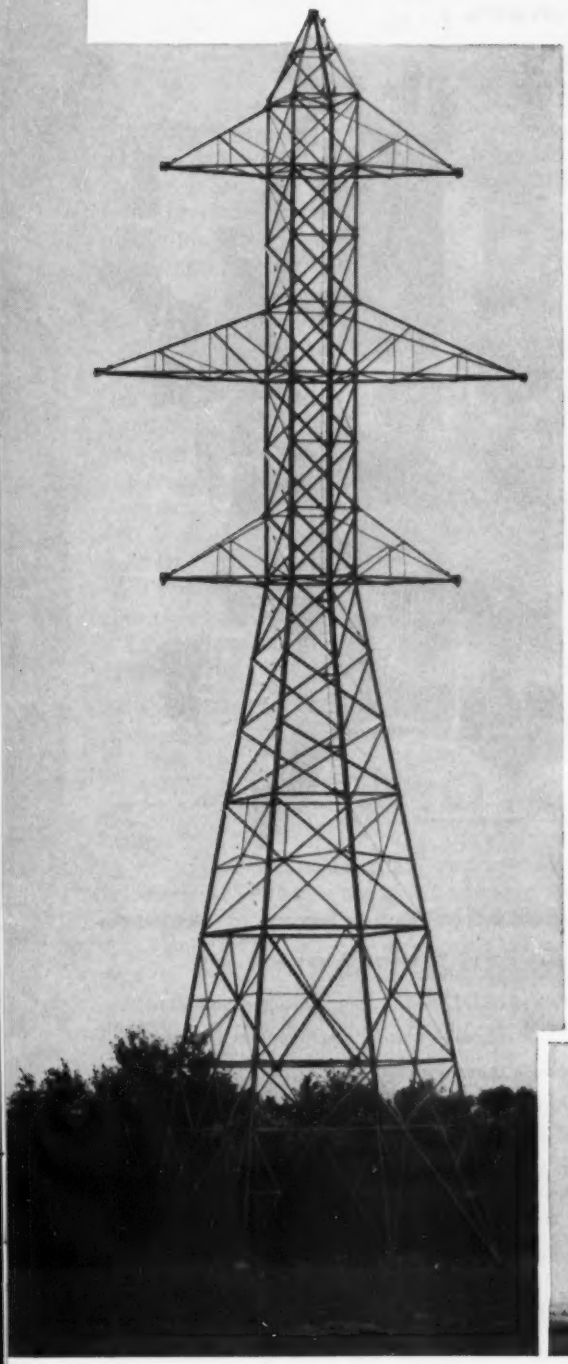
Lightweight Steel TOWERS

by

American Bridge



carry 230-KV line 205 miles across midwest prairie lands!

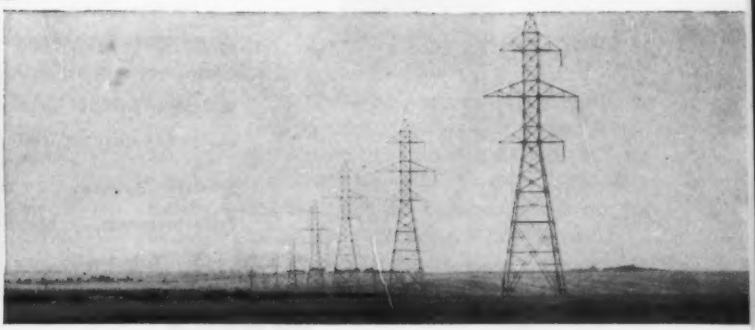
Weight is an important factor in determining transmission-line costs. Especially if your line runs through rough, remote country, and towers have to be erected in hard-to-get-to places. The bigger and heavier a tower, the tougher your problems can become.

The U. S. Bureau of Reclamation's 230-KV, double-circuit line, which runs from Big Bend, South Dakota, 205 miles northeast to Granite Falls, Minnesota, is a significant example of the use of lightweight towers to hold transportation and erection costs to a minimum.

There are approximately 850 towers averaging 150 feet in height and spaced about 1250 feet apart along this 205-mile line. By the selective use of USS MAN-TEN Steel in these towers, it was possible to save about 425 tons of weight.

This meant not only a saving in the initial cost of the structures, but also a saving in the final installation cost.

American Bridge towers are made to order for every type of transmission-line service. They are designed for simplified erection on level, side-hill, or rocky butte sites. They are engineered for heavy-duty service under the severest climatic conditions. For recommendations based on your specific requirements, just write our nearest office.



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UNITED STATES STEEL EXPORT COMPANY, NEW YORK

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EDITORIALS

The Electrical Industry's Stake in Steel

Utilities today have a big stake in expansion of the steel industry. Power systems can expand according to plan only if there is enough steel in the hands of electrical manufacturers. Right now the market for steel is tight and promises to remain so for the next five years.

Steel needs of the electrical manufacturing industry—which aggregated upwards of 2,292,000 tons in 1955—are expected to be 20% greater in 1960.

The steel shortage has been placed in bold relief by the Middle East situation and the crisis in shipping that it has created. Shutdown of the Suez Canal has brought into prospect a crash program for the construction of 50 super-tankers of 84,000 to 100,000 deadweight tonnage. This would superimpose a need for 750,000 additional tons of heavy steel plate on a ship building program that this year increased steel plate requirements 42% over last year.

In addition there are the requirements of the $50 billion federal highway program, the petroleum industry's $33 billion expenditure in the next five years and the construction industry's plans to spend $60 billion in the same period.

To meet all these growing needs, the steel industry must go ahead with its proposed plans to expand its melting and rolling facilities. This in itself will pile additional steel requirements on the industry.

The task is a monumental one, involving expansion undreamed of a few years ago, Luken's President Charles L. Huston, Jr, told the New York Society of Security Analysts, recently. New plants must be built, old ones replaced. Already, Huston said, the steel industry has on file in Washington $1½ billion in certificates of necessity awaiting government approval.

Progress of steel expansion is encouraging. But it must be followed up promptly. Much depends on it.

As we see it expansion of the utility industry depends squarely on expansion of steel facilities. . . . and both are essential to the national security.

"The Only Thing Necessary . . ."

As the dust of election settles, electric companies should heed the warning and advice voiced by Austin D. Barney, chairman of the board of Hartford Electric Light Co. In his recent presidential address before the Association of Edison Illuminating Companies Mr Barney warned that the utility industry "because of our fear of getting into politics" has failed to accept sufficiently its citizenship responsibilities in combatting the socialistic forces which are active in this country.

"Unless we become politically effective, the social and political forces from which we tend to stand aloof are going to overwhelm our technical and economic competence."

What marks Mr Barney's comments with distinction is the manner in which he carries them beyond what has been written and said on the subject.

"Top executives must come to believe that this changing philosophy is the Number One problem facing our industry. They must give to it an importance equal if not superior to that given the operating and technical problems of their organizations.

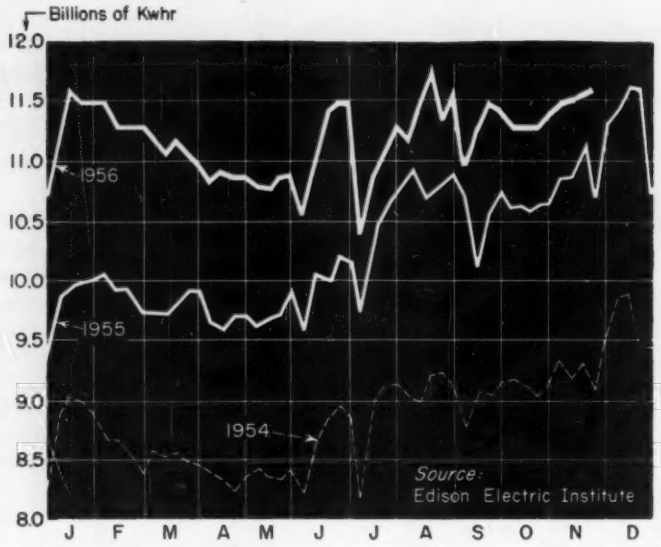
"I venture to suggest that a department under the supervision of a top executive be set up to work on this problem and that such an officer should have this as his major responsibility. . . .

"There is no reason to doubt that our industry can cope with this problem of political philosophy as it affects us, to the same degree that it has coped with its technical and economic problems. I base this conviction on what our industry has accomplished to date on this problem. . . .

"The United States of America stands today as the only real, powerful, staunch bulwark in the world for the defense of the free individual and the free society. Our obligation to defend the free society which we enjoy far transcends our interest in our business. Our obligation is the obligation of Americans."

There is little that we can add beyond the quotation from Edmund Burke with which Mr Barney closed his address:

"The only thing necessary for the triumph of evil is for good men to do nothing."



OUTPUT

Week ended Nov. 17, 11,589,000,000 Kwhr Up 3.9%

Atomic Energy Commission requirements—1,125,000,000 kwhr (Electrical World estimate). Excluding AEC, output increase was 3.8%

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Nov. 17	+3.9	+3.6	+3.8	+3.6	+4.0	+5.7	+7.2	+3.7	−3.7	+4.6
Nov. 10	+5.9	+9.6	+4.0	+4.0	+7.3	+4.8	+12.4	+8.2	+9.5	+6.9
Nov. 3	+5.8	+5.6	+5.5	+3.1	+6.7	+4.0	+12.0	+9.5	+12.7	+8.0

Seasonally Adjusted Index 219.0 Week Ago 219.7 Year Ago 210.7

Here are the issue's highlights . . . Will there be any significant changes in Ike's power policy following current reappraisals in Washington . . . Two Mississippi co-ops propose T&G network which would cross that of private utilities . . . AG&E slates second 450,000-kw generator for Sporn plant to bring over-all capacity to 1,050 Mw . . . Interior to ask FPC to review Reynolds rate pact . . . Britain will erect new nuclear power station in Scotland . . . Union Electric discloses facts on $35,000 fee paid to "legislative agent" . . . Con Ed celebrates diamond jubilee of use of underground cable . . . How to pick the right man for the right job . . . Two transformers connected open-delta serves customer whose load is mainly lighting . . . Meter change adapter comes in handy for changes from two to three wire services.

NEMA's Electric House Heating Equipment Section and major heat pump manufacturers announce they will participate in EW's Electric Space Heating & Heat Pump Conference. They will join about 15 company executives as speakers at meet slated for Barbizon-Plaza Hotel Dec. 5, Plaza Hotel Dec. 6.

Whither foreign trade? Italian firm's low steel tower bid won New York Power Authority contract last week. Societa Anomina Electrificazioni will supply 500 tons of steel for St. Lawrence . . . Meanwhile, Seattle city council rejected mayor's plea to re-study resolution opposing use of foreign-made materials on public works projects. Council questioned wisdom of buying "from foreign plants where wages are much below" U. S. standards.

Congratulations . . . Harllee Branch, Jr, president of Georgia Power, a subsidiary of the Southern Co, assumes presidency of the parent firm. He succeeds **C. B. McManus,** who moves into new post of vice chairman of the board. **John J. McDonough** succeeds Branch and **J. M. Oliver** fills McDonough's executive vice president position.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Washington Wire . . . Carolina Generating Co's $252,186 rate cut is postponed. Decrease to Georgia Power, which FPC ordered Oct. 24, is shelved pending FPC action on CGC's request for rehearing. If this is turned down a 60-day stay will permit a court review petition . . . U. S. Court of Appeals denies Hells Canyon Assn petition for rehearing of decision upholding legality of FPC's license for Idaho Power's Snake River dams . . . DuPont to study heavy water-moderated reactors for power generation at AEC's Savannah River (S. C.) plant . . . Prices for licensed reactor operators' by-products released by AEC. For plutonium it pays $12/gram; uranium-233 nitrate, $15/gram.

Safety, not private vs public power, will be the issue in power reactor hearings, say Power Reactor Development Co officials. PRDC will present top scientists from U. S. and abroad for Washington D. C. sessions starting Dec. 10. They will back up Pres Walker L. Cisler's claim that proposed $54-million Monroe, Mich., reactor "presents no hazard whatever." Also at stake, though, according to some observers, is role of free enterprise in atomic power production.

General rate increase for Los Angeles Dept of Water & Power ups residential electric bills, ranging from 7 to 30¢ a month, starting Dec. 1.

Drought is hitting Arizona hard. In driest siege in 750 years, Salt River Power District's 68-Mw hydro system will produce next to nothing in 1957 unless rain falls. State's central farmers face an irrigation cutback to one acre-ft as Water Users Assn storage drops under 5% capacity. Unless something is done to develop new sources of water, amount of land that can be irrigated will drop 50,000 acres a year, estimates Dr G. W. Barr, Arizona U.

A piracy charge against Washington WP is "outlandish nonsense," says George Brunzell, assistant to the utility's president. Inland Power & Light claims WWP's 22-mi line and a substation near Blanchard, Idaho, has one purpose—taking away the co-op's customers. Not so, counters Brunzell. "Before Inland began moving into this area we had a petition from about 80% of the electricity customers in and around Blanchard for our service," he declares.

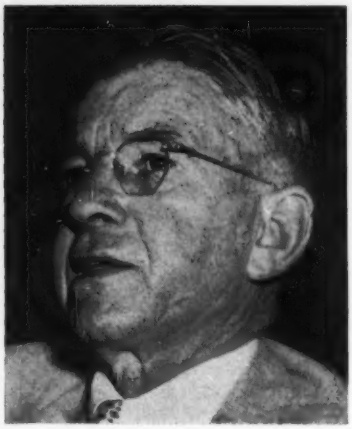
ABOUT PEOPLE IN THE INDUSTRY

"Public power socialists" haven't relaxed efforts in trying to gain control over U. S. power industry, said **Harold Quinton,** president, Southern California Edison. "The matter of greatest interest to investors in electric utilities is the preference problem . . ." and its concomitant government competition. No basic energy element can be regulated or controlled without extending same regulation to others, he warned.

Pacific Northwest power picture is brighter. Cooperation of utilities and federal government "in moving to meet the region's power needs," said BPA's **William A. Pearl,** has moved predicted 1961-62 deficits back three years, based on critical water conditions. Power to meet all firm and interruptible loads in Oregon, Washington, and parts of Idaho and Montana is in sight through 1965 under median water conditions, he said.

More News About People page 174

New Interior Secretary Seaton (left) must consider Former Secretary Douglas McKay's (right) defeat in Oregon as he answers question:



Will Ike Switch Power Policy?

The Eisenhower Administration's power policies are undergoing reappraisal in Washington, but any basic changes are not in the cards for the present. The Administration will step up effort to obtain greater public acceptance of present policies, and Washington will shift on a piecemeal basis, if at all.

The reappraisal has been sparked by two opposing facts:

- The defeat of a number of Republican candidates in the water and power conscious West and Midwest;
- The popular mandate for President Eisenhower's Administration for another four years.

The defeat of such GOP candidates as Douglas McKay in Oregon, Arthur Langlie in Washington, Dan Thornton in Colorado, Herman Welker in Idaho, and Sam Coon and Harris Ellsworth in Oregon, is definitely figuring in the Administration re-examination of its policies. But with a new 4-year term and a relatively new Interior Secretary (and associates describe Fred Seaton as "not the type who stands still"), the reappraisal was scheduled in any event.

Power Wasn't Key Issue

Interior officials are not prepared to state categorically that power or natural resources issues were mainly responsible for the party's showing in the West-Midwest.

Even observers in some key power states seem unsure on this score.

For instance, Oregon wheat farmers' discontent with parity policies is cited as a major factor in Albert Ullman's defeat of Rep Sam Coon (author of the John Day partnership bill). In the same state, Charles O. Porter is believed to have received his biggest assist in defeating Rep Ellsworth (he sponsored partnership at Green Peter-Cougar projects) from lumber mill employees who blamed curtailed mill operations on tight money affecting housing.

Even in the much-publicized McKay-Wayne Morse fight, neither side emphasized the power issue to the exclusion of other issues. Across the state line in Idaho, site of Hells Canyon, Welker's defeat is seen as much a matter of personality as was any issue, including power. Here too, Rep Hamer Budge, foe of federal power development, won without trouble.

Surveys Rank Power 5th

Pre-election surveys taken in the three Pacific Northwest states consistently indicated that the federal power issue was far down the list as a vote-getter. It ranked fifth on a list of six pertinent issues that were tested in Oregon. In the Oregon senatorial campaign, billed nationally as a test of the Administration's power policy, no more than 10% of Morse's supporters gave any weight to the issue of power and resource development.

A public opinion survey conducted in the Puget Sound area of Washington showed public sentiment three-to-one in favor of the Administration's partnership policy for hydroelectric development. In the presidential race in the northwest, less than 1% of the voters indicated concern over power development.

To attribute the poor Republican showing in these states largely to power would be an oversimplification, Interior officials feel. At the same time, they are not prepared to dismiss them. Thus, at present, the emphasis will be on explaining partnership rather than on changing it.

Said one Interior official: "We feel there has been a failure to explain our policies adequately to the public."

No Change—Here's Why . . .

That no public announcement of a change in partnership policy is planned, was confirmed by Seaton before the National Reclamation Association Annual Convention in Salt Lake City, Utah, Nov. 16.

"We have several proposals ready for consideration by the next Congress which provide for partnership development of multipurpose river structures," said Seaton. "We see no reason to inflict the whole burden of financing these projects on the federal government wherever and whenever non-federal interests are willing to assume a share. So long as the public interest is protected, the end results are the same."

Seaton's speech also seemed directed at answering criticisms by public power proponents. For instance, he said Interior would continue to scrutinize all non-federal projects to make sure they "fit into the multipurpose needs of the river basin."

"Make no mistake—our rivers and streams are publicly owned resources," he said. "We are taking every possible measure to protect and enhance the public interest in them—and we should. But we do feel that they should be used, because conservation does not mean stagnation in our dictionary."

The current reappraisal is concerned also with getting key projects underway. A hard look may convince Seaton that compromise—the time-honored way of working out Washington stalemates, will be necessary on some projects.

Seaton has argued since coming into office that it will take money from "every source" to meet America's expanding power needs. He has stressed that neither Congress nor the American taxpayer will want to underwrite all the billions of dollars needed for new power generation.

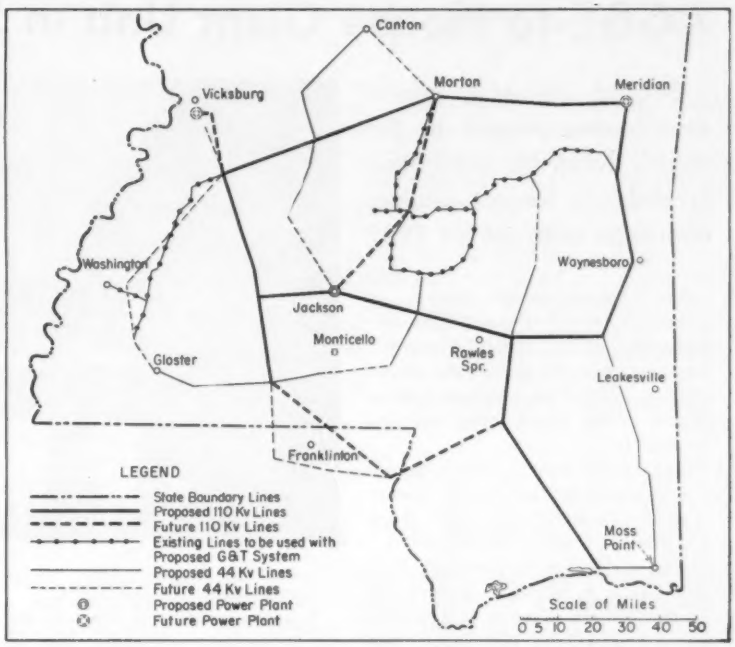
Four Federal Plans Stalled

Seaton cites a number of cases to back his point:

- Coosa River, stalled for years for lack of federal money, and finally de-authorized as a federal project to permit Alabama Power Co to develop it.
- Markham Ferry similarly remained inactive until Congress authorized an agency of the state of Oklahoma to take it over.
- Hells Canyon, another case where Federal funds were not forthcoming.
- Currently, John Day has been on the books for about seven years with only planning funds coming out of Congress.

Actually the Eisenhower partnership policy provides plenty of latitude to move in any direction. Its purpose has been many-fold: to decentralize as much as possible federal dominance of public works developments; to shift as much of the cost as possible away from the federal budget; to have the beneficiaries take the responsibility—financial and otherwise—for the development of public works projects; and to get needed projects built as quickly as possible.

If "partnership" truly can be explained to the people, it should encounter less resistance in the future—especially if the GOP grabs credit for "thinking up" projects for partnership development.



CO-OP GENERATION AND TRANSMISSION NETWORK proposed for Mississippi overlaps present service areas of privately-owned utilities. PSC must rule

Co-ops Plan Statewide System

Plans have been spread before the newly-formed Public Service Commission in Mississippi for an extensive transmission and generation network which would reach to many points in the state. These proposals come from two rural electric cooperatives—West Mississippi Electric Power Association and South Mississippi Power Association. Although formed in 1941, neither of these organizations have until now showed any sign of actually constructing such facilities.

The question now puzzling Mississippi utility men is whether these G&T co-ops will remain paper organizations or whether they are serious in their proposals placed before the PSC.

There is a good reason for the proposals coming forward at this time. The state legislature this year passed a new utility regulatory law setting up the PSC. For any firm to qualify as an operating utility, it must either have been in business at the time the law was enacted or it must convince the commission that public convenience and necessity would be served by its operation. What the co-ops are trying to do is to show that they were going concerns at the time the regulatory law was enacted.

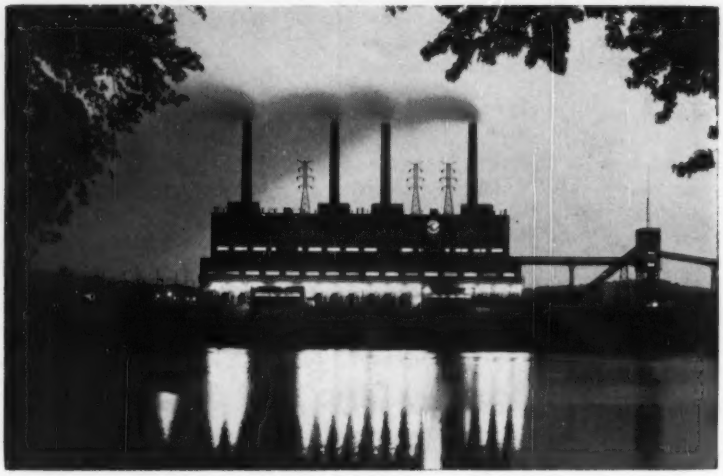
The two co-ops now contend that they have spent some $75,000 on engineering and feasibility studies and such expenditure constitutes "construction" as defined by the PSC Act. From this they argue that they were duly constituted utilities and are entitled to certificates of public convenience and necessity without further proof that the facilities and service they propose are needed.

The PSC, of course, will be expected to rule as to whether the co-ops actually qualify for certificates by reason of being "engaged in construction or operation defined by law.

Thinking among some electric company executives in Mississippi is that the action of the co-ops is of a "taking out insurance" nature. One top executive put it this way, "After all, these co-ops have been chartered for 15 years. One would think that if they had intended to exercise their franchises, they would have done so by now. Co-ops always want the alternative of their own generating and transmission facilities. This step on their part, I feel, is simply an effort to avoid difficulty with the PSC later on in the event they decide to go ahead with their 1941 plans."

AG&E to House Giant Unit in Sporn Plant

Second 450-Mw generator, called largest in the world, slated for installation in system's largest station, operation date set for 1959



The largest power station in American Gas & Electric Co's system—the Philip Sporn plant—has been chosen as the site for the second of two 450,000-kw generating units, largest in the world, being installed by AG&E.

The Sporn plant is jointly owned and operated by two AG&E operating subsidiaries—Appalachian Electric Power Co and Ohio Power Co.

Like the first unit, now being built by Indiana & Michigan Electric Co on the Wabash River in Indiana, the Sporn unit will be 73% larger than any power producing unit now in operation (EW, Sept. 3, p 76.)

AG&E Pres Philip Sporn said the 600,000-kw Sporn plant, located at Graham Station, W. Va., was chosen for three reasons. They are the need for additional generating facilities in the Ohio Valley; proximity to abundant, low-cost coal reserves; and the plant's nearness to the geographical and load centers of the AG&E system.

Construction of the $58-million project is scheduled to begin early in 1957 with a completion date tentatively scheduled for late 1959.

Upon completion of the new unit, the Sporn plant will have a capability of 1,050,000 kw, making the station one of three in the world to have capacities in excess of 1,000,000 kw. The others, also located on the Ohio River, are 1,290,000-kw Clifty Creek plant at Madison, Ind. and 1,075,000-kw Kyger Creek plant at Cheshire, Ohio.

Both new units, upon completion, are expected to show an improvement of 5% in thermal efficiency over the world's best unit to date. A 7½% improvement in capital cost per kw of generating capacity is also expected, as a result of economies due to larger size of unit, higher turbine speed, space reduction, and elimination of boiler house.

The Sporn unit will utilize close to 3 million pounds of steam per hour at the above critical pressure of 3,500 psi, and will consume 1,300,000 tons of coal yearly. Its steam temperature will be 1,050 F.

The turbine generators for both units, which will be cross-compound in design, will be built by General Electric Co. The 23-story boilers for both units, which will be of outdoor design and will exhaust to a stack with a height of more than 500 ft, will be constructed by Babcock & Wilcox Co.

Review of Reynolds Pact Sought

The proposed rate increase for Southwestern Power Administration recently announced by the Interior Department has raised objections of opponents who contend the rate hike would apply only to preference customers.

What the objectors referred to was the aluminum power contract with Arkansas Power & Light Co and Reynolds Metals Co. This contract was signed in 1952 during the Truman administration and runs for 30 years. Now Interior has announced that it will ask the Federal Power Commission to review these rates.

The review has been requested at the same time that FPC considers the proposed new rate schedule for SPA recently announced by Interior. The new schedule calls for 6.97 mills, about a 40% increase. The Reynolds rate is 5.2 mills.

Interior Secretary Fred Seaton said that if FPC finds that the existing Reynolds rates do not meet the requirements of law he will increase them to the level of the proposed new rates.

Seaton revealed that officials of his department believed the Reynolds pact was illegal and that it "violated the rate-making provisions of the Flood Control Act of 1944."

This act requires that rates schedules should permit recovery of cost of producing and transmitting electric energy, including cost of amortization of the capital investment allocated to power over a reasonable period of years.

The department's studies indicate, Seaton said, "That the existing basic average rate in the aluminum contract does not meet the cost of providing the service. Application of the proposed rate schedule for peaking service to the aluminum contract would return the revenues necessary to recover the federal investment as required by law."

Rain Makers to Vamp

A team of 14 men from Norway's Institute of Weather and Climate Research this winter will set out to woo rain to North Norway where it can be used more effectively for hydro-power production. The rain-making experiments are aimed at avoiding a serious power shortage this year. Last year dry weather in the Norwegian highlands was blamed for several shortages while rain fell in the lowlands. The experiments are backed by Norway's Hydro-Electric Power Board and Norsk Hydro, an industrial firm.

Election Returns & Load

A strange pattern showed up on its system load charts on election day, reports Central Illinois Light Co. In contrast with the previous Tuesday, daytime load ran lower because mines, taverns, and many industries were shut down. Radios and television sets came on earlier than usual in the afternoon and system load was normal by 5:30 p.m. It jiggled up and down until 10—then began a dramatic climb to a 14,000-kw-above-normal peak at 1 a.m. as Stevenson conceded and Eisenhower acknowledged victory. Load was 3,000 kw below normal by 5 a.m., but nearly 6,000 kw above normal by 6 as listeners tuned in radios again to hear late returns on unsettled races.

Test Reactors & Industry

The Atomic Energy Commission is calling on industry to take on greater responsibility in providing test reactor facilities. Specific industry proposals for such installations are to be sought later.

To encourage private industry, AEC will construct test reactors only if its needs for irradiation space cannot be met by private industry. AEC will contract with outside firms for a percentage of space for governmental use. AEC also will permit the use of its existing facilities for non-government purposes only if privately owned facilities are unavailable.

The reactors required are for testing materials and reactor components which may be subjected to intense radiation and corrosive materials, and to test electronic components of military vehicles or equipment.

Federal Roads to Take Toll

The federal highway program inevitably will take its toll among California users of electric, gas, water, and telephone services, predicts B. K. Dunshee, manager of Pacific Gas & Electric Co's land department. He said PG&E spent $2.5 million during the last fiscal year in relocating facilities to accommodate the state freeway program. The company got "slightly more than half" of this expenditure back from the state, but "in the long run, these annual remainders will be paid for by the company's customers," he said. The federal program is expected to aggravate the problem.

Meanwhile, Oregon's utilities have asked the State Highway Commission to help them seek enactment of state legislation next year that would permit the use of federal aid highway funds for relocation of utility facilities affected by road construction. A provision of the new federal highway act says such payments can be made if such payments would not violate state law. However under present Oregon law, these payments would be illegal.

Soft-Eyed Fish Expert

In an effort to compromise power and fishing interests, Pacific Power & Light Co has hired Dr Roy Hamilton, a soft-eyed young biologist who has served 15 years on the International Pacific Salmon Fisheries Commission. He is aware that some conservation zealots consider power companies to be national enemies of fish and game, but he does not believe this a realistic attitude.

"Dams are part of the machinery of progress," he said, "I believe that reasonable solutions of fisheries problems can only be reached if qualified men work directly with industry." Apparently others hold the same opinion. His former university teachers and his associates on the salmon commission urged him to take the job offered by Pacific P&L.

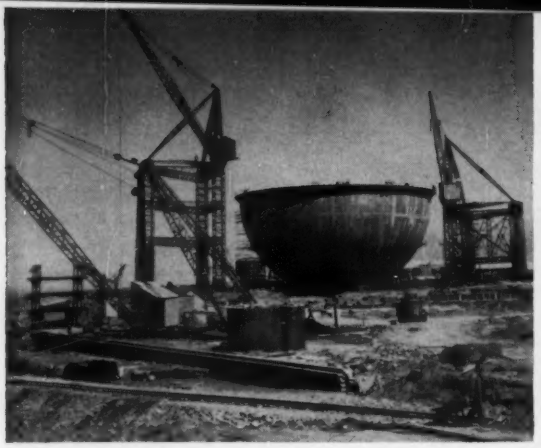
Alcohol: A Water Saver

Akin to pouring oil on troubled waters, utilities some day may pour a special type of alcohol on their reservoirs to reduce evaporation. Roy W. Morse of the Department of Interior told the American Public Health Association that the special alcohol stops evaporation but does not affect potability. The alcohol spreads itself in a thin layer of molecules upon the surface, trapping water molecules beneath it.

With hydro power production seriously threatened already in various drought-stricken areas, and with utilities scrambling to preserve condensing water for steam plants, Morse's revelation seemingly takes on added significance.

Light Bulbs for Ceylon

From the small island off the southeastern tip of India comes word that Ceylon's Ministry of Industries has okayed the establishment of Ceylon's first light-bulb factory. The plant will cost about $320,000.



Lower half of sphere . . .

Awaits installation of reactor as . . .

Britain Erects New Nuclear Power Station

New atomic power station being undertaken by the British government is its fast fission breeder reactor now under construction at Dounreay, Scotland.

The Dounreay research reactor, which will also produce some electricity, is part of the government's plan to install at least 16 nuclear power stations by 1965 which will generate electric power into the national supply service.

The nearly completed lower half of the Dounreay sphere, shown at left, is a bowl 70 ft high and 140 ft across. Inside the bowl (right) is the top of the concrete reactor vault, in the center of which the fast breeder reactor will be housed.

Arranged around the reactor are the 24 primary liquid metal heat exchangers which will take heat from the reactor on the first stage of its journey to the turbines. When the upper half of the sphere is erected, the reactor will be totally enclosed.

The United Kingdom Atomic Energy Authority now has 21 reactors either in operation or under construction. Two of these, at Windscale, Cumberland, are for the production of plutonium. Eight others—four at Calder Hall, Cumberland, and four at Chapel Cross, Scotland—will produce plutonium and also generate electricity into the national grid.

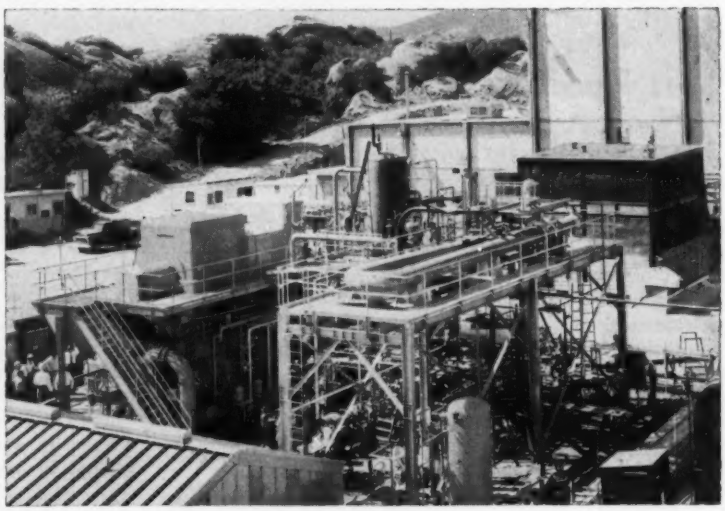
A&FP Plans Reactors in Mexico, Cuba, Brazil

American & Foreign Power Co has announced plans to install a 10,000-kw nuclear power reactor in Mexico, the third such unit ordered for Latin American countries. The other two are planned for Cuba and Brazil.

Pres Henry B. Sargent, who made the announcement at the Western Area Development Conference in Phoenix, said the atomic plants will supplement a $47-million A&FP expansion program in Mexico, a $147-million program in Cuba, and a $250-million expansion program in Brazil over the next five years.

Cuba and Brazil have reached an advanced stage in negotiations with the United States for bilateral agreements on atomic fuel. Mexico has not yet entered negotiations, but Sargent expressed hope that it would be possible to install a plant there.

Sargent said the company's program of property improvement is expected to increase generating capacity of the system about 80% at a cost of more than $500 million.



Nuclear Power Plant Underway in West

As part of Atomic Energy Commission's program to develop economical power from atomic energy, Southern California Edison Co and Atomics International have joined forces in Sodium Reactor Experiment, now being constructed in Santa Susana Mountains near Los Angeles. Reactor will be in background building, generating plant in foreground. Although an experimental project, it will be the first non-military reactor in the U. S. to feed electricity over private utility lines on a commercial basis.

$35,000 Fee Paid to "Legislative Agent"

Union Electric Pres McAfee discloses full details of payment to lawyer for keeping tabs on legislation

Union Electric Co Pres J. Wesley McAfee has agreed that an officer of the utility paid $35,000 to a Chicago lawyer for keeping tabs on a bill recently passed by the Illinois General Assembly. In a report to the utility's board, McAfee said it was the duty of the company to expose the matter to full public view.

The transaction, termed a "serious mistake" by McAfee, will be investigated by the Securities & Exchange Commission as a possible violation of a section of the Public Utility Holding Company Act, which makes it illegal for a public utility to contribute to a political candidate, an office holder, or a political party.

A check of $7,500 and subsequent checks totaling $27,500 were made out to J. Roy Browning, Chicago attorney, for legal work involved in a bill passed by the 1955 legislature which enabled the utility to dissolve an Illinois subsidiary, thereby enabling the utility to merge its Illinois properties into the Missouri company for bookkeeping purposes.

Browning, however, said he received none of the money. He said he had endorsed the first check of $7,500 and turned it over to Orville Hodge, former Illinois state auditor who is now serving a prison sentence for misapplying about $1.5-million in state funds. Browning declared he never saw the other checks.

Harry C. Williamson, real estate and tax officer for Union Electric, has acknowledged that he delivered the remaining $27,500 in checks to Hodge's office.

Company officials said they had not authorized Hodge's employment and were "shocked and surprised" that the money paid to Browning to steer the measure through the legislature had been turned over to Hodge. Williamson, although remaining on the payroll, has been relieved of all duties requiring contact with public officials or government agencies.

Meanwhile, U. S. Attorney John B. Stoddard, Jr. has disclosed that if the proposed SEC inquiry turns up evidence warranting criminal prosecution, the matter would be presented to a federal grand jury.

"SEC's probe," said Chairman J. Sinclair Armstrong, would be "a nonpublic, fact-finding investigation."

McAfee also disclosed that he had approved a $2,500 bonus for Williamson in connection with passage of the Illinois bill. Officers of the company, said McAfee, had commended Williamson.

"Underground" – A Diamond Jubilee

The diamond jubilee of Consolidated Edison's use of underground cable was celebrated Nov. 14 by the NEMA wire and cable section. David Williams, manager of Consolidated Edison's Cable Purchasing Bureau commemorated the event by presenting the picturesque history of the growth of the wire and cable industry and the growth of Con Ed's cable system. He is shown here holding a section of the first Edison two-wire tubes. These were laid in New York City in 1881. On the right is a section of the 132-kv hollow core cable installed in 1927. And on the left is a section of modern high pressure pipe type cable.

On Nov. 2, 1880, Edison demonstrated the first 120 volt dc underground distribution system at Menlo Park. And on Feb. 14, 1881, he formed the Edison Tube Works.

Installation of the first two-wire tube began on April 19, 1881. By the end of the year 30,000 ft containing 57,000 lbs of copper had been laid. The mileage of underground lines has grown from 6 mi in 1881 to 54,000 mi today. In terms of copper consumption, the Consolidated Edison system has grown from 57,000 lb in 1881 to 269 million lbs in December of last year. The system has another 41 million lbs in its overhead lines.

While the total copper installed amounts to 310 million lbs, technology and system changes have required the procurement of more than 531 million lbs.

Cable: The Old and New

Engineering Center To Be in New York

A contract for preliminary architectural plans and studies for a new Engineering Center for the United Engineering Trustees, Inc, in mid-Manhattan, New York City, has been signed with Shreve, Lamb & Harmon Associates, designers of the Empire State Building. It is believed that preliminary plans will be completed next year.

UET is composed of four major national engineering societies. They are: American Society of Civil Engineers; American Institute of Mining, Metallurgical and Petroleum Engineers; American Society of Mechanical Engineers; and American Institute of Electrical Engineers.

These four societies, and a fifth that is expected to become a member, American Institute of Chemical Engineers, have voted through governing boards to remain in New York City.

The announcement did not indicate any details as to specific locations, cost, or time of completion. However, it is expected that financing will run into "several million dollars." UET has also been assured of cooperation of a group of industrialists and educators toward the fund.

Fast Pace of Engineering Progress

Highlights of reports of the technical and commercial committees presented at the annual meeting of the Association of Electric Illuminating Companies are given in the larger type at the right. Committee activities were given a prominent place on the three-day program of the meeting held recently at Boca Raton, Fla. Over 400 utilities executives participated.

- **Volume of power generation equipment orders stand at high level. This year's 12 month total will nearly double last year's**
- **Spectacular increase in size of turbine-generator and boiler units attributed to advances in cross-compound design, direct-cooling of generators, and development of longer turbine blade**
- **Extra-high voltage underground cable development research soon to be launched as active project**
- **Need voiced for high-capacity test station capable of proving ability of 25-million-kva circuit breakers to meet interrupting rating**

POWER GENERATION COMMITTEE

Among the year's developments in power generation highlighted by George P. Gamble, chairman of the AEIC Power Generation Committee, significant emphasis was given to:

1. The high volume of power generation equipment on order by utilities.

2. Spectacular increase in turbine generator and boiler sizes on order.

3. Popularity of steam reheat in modern power systems.

4. Widespread acceptance of direct generator cooling methods.

5. Recent innovations in cross-compound turbine design, notably the use of 3,600 rpm on both shafts and resort to twin units with multiple exhaust.

The 17 million kw of generating capability ordered in the 12 months to May 1 is nearly double last year's volume and nine times what it was in the low year 1953-54, Gamble said. Over two-thirds of it was purchased in multiple orders.

Why Units Are Getting Bigger

Today's "spectacular" increase in unit size was attributed by Gamble to growth in utility system size and widespread interconnection. Six units in the 300-335-Mw size range were on order up to May 1 and two 450-Mw units have been selected by American Gas & Electric Co. Likelihood of 1,000-Mw units ten years hence was suggested by Gamble, who is a vice president of Union Electric Co.

Direct cooling of generators has continued to find favor, Gamble reported. He credited it, along with the long turbine blade, for making possible the increase in unit size. Of the 135 machines ordered this year, 48 had direct-cooled rotors, and 30 of these had direct-cooled stators.

Use of steam reheat is universally accepted today for all but the smaller units and this year was used in 85% of all capability purchased. Excluding super-critical units, average steam pressure for reheat units exceeded 2,000 psi, 100 psi higher than last year. Initial steam temperature averaged 1,025F and reheat steam temperature 1,010F although for larger units, say 175 Mw, temperatures of 1,050/1,000F were general, Gamble stated.

A landmark in boiler size was reached this year when average rating topped 1,000,000 lb per hr. Included were four once-through boilers in which no water is either circulated or stored. Most of the big boilers had two separate furnaces and some still larger units may have three furnaces in the future, Gamble predicted. However one boiler design of the very largest size had one furnace using opposing cyclones firing into a small furnace bottom and cooled exit gases by tempering with recirculated flue gas.

Another significant new development in turbine arrangement, Gamble said, is represented by four cross-compound machines with both shafts operating at 3,600 rpm and having exhaust wheels on each of two shafts. First two of these machines were ordered by Public Service Electric & Gas and are rated 275 Mw each, have four exhausts, two on each shaft. Two 450-Mw units ordered by American Gas & Electric each have six 3,600 rpm exhausts three on each of the two shafts. Generators are identically rated and liquid cooled.

Philip Sporn, president, AG&E, reviewed his company's philosophy in selecting two 450-Mw turbine generators. He also discused progress with the installation of the industry's first 4,500-psi super-critical pressure turbine generator unit at Philo Station, soon to be placed in operation.

Manufacturers' Comments

Glenn B. Warren, General Electric vice president, estimated that the industry lost 5 to 7 million kilowatts of generating capacity as a result of the lag in equipment orders in 1953-54. Order volume appears to be fluctuating on a 5-year cycle, and he said manufacturers must find a way to smooth out the flow in their plants.

Warren asserted that it is sound policy for the industry to use re-superheat and even double re-superheat and to hold down temperatures for some time to come to what can be obtained with ferritic materials.

There is increasing evidence, he said, that the gas turbine may have an important future in connection with nuclear power plants. Developments are being watched which will lead to the economical production of superheated steam in nuclear power plants.

It appears important for the industry to make a serious long-range study to find out how fast turbine generator unit sizes can be increased from a power system standpoint, Warren asserted.

Brought Out at AEIC Meeting

- Studies of soil thermal resistivity advance toward completion in 1957
- Further standardization of meters and coordination of meter engineering with accounting and rate making functions are sought
- Automatic watthour meter testing facilities under development by two utilities
- Load research group reports findings of house heating study, undertakes cooperative study of residential lighting load characteristics
- Workshop conference on appliance servicing called to show complexity of repair and to seek improved design

J. F. Roberts, vice president, Allis-Chalmers Mfg Co, said his company's experience wth two installations of its new induction type exciter without brushes or commutators has been very satisfactory. Early difficulties with deflection at critical speed is being overcome.

Both Roberts of AC and Warren of GE discussed joint industry efforts with steel companies to develop procedures to secure better spindle and rotor forgings for turbine generators and to perfect inspection methods.

Roberts reported that use of fly ash as a component of concrete is increasing. Marquette Cement Co will shortly place in operation at Milwaukee the first commercial cement plant to use fly ash as an ingredient in the raw cement mix. Wisconsin Electric Power Co will supply the fly ash.

POWER DISTRIBUTION COMMITTEE

The AEIC sponsored program to develop and test extra-high voltage underground cable will shortly be formalized and launched as an active project. Plans for industrywide participation and financial support are being considered. E. R. Moore, chairman of the Power Distribution Committee, summarized progress of the project this way:

1. An acting steering committee is working with cable manufacturers on general specifications and performance requirements.

2. Proposed tests and specifications have been discussed with foreign manufacturers and users.

3. Possibilities of conducting tests on college or university campus have been explored.

4. Consent has been secured to move test transformers from the Tidd test station to such a site.

Soil Studies Nearly Ready

Studies of soil thermal resistivity jointly sponsored by AEIC and AIEE and the Engineering Foundation will be completed in 1957. The study will provide information on effects of different types of soil and how to predict optimum loading of cables under all these conditions. Progress to date covers soil factors to be considered and a bibliography on thermal conductivity of soil and factors influencing them.

The Power Distribution Committee reported an accelerating trend to extra-high transmission voltages. Next year 1,200 circuit miles of line will be in operation at 330 to 345 kv. Moore said that there is still much work needed to learn about radio influence and determining means of assuring adequate lightning protection.

In the area of distribution, development of high-speed 2-4 cycle 5-kv air circuit breakers is in progress. Use of aluminum aerial cable for secondary and services is increasing. Several companies report adoption of 265/-460 v. One company has services totaling 33,000 kva at this voltage and 30,000 more in prospect.

ELECTRIC SWITCHING AND SWITCHGEAR COMMITTEE

Proposal that electrical manufacturers and users pool resources to create a single switchgear testing plant with capacity enough to meet testing needs of present and future switchgear was made by the Committee on Electric Switching and Switchgear. In presenting the proposal, Chairman Oscar Bauhn, Public Service E&G, pointed out that the industry has established breakers of 10, 15, and 25-million kva interrupting capacity yet cannot verify their ability to handle these values because no single test plant has enough capacity to perform an overall test.

Need for a satisfactory capacitor switching device was characterized as urgent by Bauhn. He called for intensive development work to perfect one.

Completion of mechanical standardization of transformer and circuit breaker bushings in the higher voltage ratings was sought by the committee. Such standardization would save 30% of the capital outlay in spare bushings—which runs into seven figures, Bauhn said. Standardization now in ASA committee hands has been slow because of lack of agreement on capacitor taps, stud diameters and shank lengths, and the like.

Interest in air-blast breakers, 60 kv and up, is increasing as shorter outage for maintenance and ability to handle repeated short circuits are appreciated, it was said.

Metal-clad switchgear continues to be a bothersome item in the lower-voltages, the committee reported. One of the troubles is the combustibility and moisture absorption characteristics of fibrous insulation used in outdoor equipment. Users now prefer porcelain for bus insulation, it was said.

Manufacturers' Comments

J. F. Roberts, Allis-Chalmers, said his company's approach to high-voltage circuit breakers for 330 kv and high potentials is with modular units. Capacitor switching means are being tested with conventional breakers and vacuum switches. He described the 400,000-kva transformer

bank, being built by his company for Philadelphia Electric Co, which has coolers arranged to serve either of two 200,000-kva transformers in an emergency, thus providing increased load carrying capacity. Roberts also described the design of a load tap changer developed to take care of increased ratings of transformers. The design described is suitable, he said, for transformer banks of 1.3-million kva and a 20% range in 32 steps.

GE's C. H. Linder questioned the practicability of a switchgear test station capable of testing circuit breakers of 25 to 40-million-kva interrupting capacity. He estimated such a test station would cost in the order of $40 million and might raise serious legal questions if built jointly by manufacturers and users.

METERING AND SERVICE METHODS COMMITTEE

Six ways in which AEIC's Committee on Metering and Service Methods is seeking to achieve satisfactory metering at reasonable cost were reported by Chairman R. B. Swallow, Public Service E&G. They are these:

1. Standardization and reduction in number of manufactured items.

2. Coordination of meter engineering, accounting, and rate making.

3. Simplification of meter records.

4. Lower cost installation methods.

5. Consideration of economic factors concerning retirement.

6. Lower maintenance cost through lengthened tests schedules and effective methods.

Standardized Meters Sought

In its standardization work the meter committee is working toward these meter groupings: A self-contained meter good for any potential up to 480v and any current up to 200 amp, a transformer-type meter for higher currents or voltages, each available in single-phase and polyphase types, Swallow said.

In accounting and rate making, there is need for coordination of the simple basic requirements between meter superintendents, accountants, and managers of rates. Some rates have been established without consideration given to cost of metering. Such lack of coordination can increase costs of metering unjustifiably, Swallow said.

Under today's conditions it appears that the metering records have become unduly elaborate and expensive. To bring these costs in line with needs, a new subcommittee has been assigned to study the cost of maintaining records.

The trend toward socket meters has increased since prices have been revised in favor of socket meters. Accordingly standards for socket mountings have increased in importance. A new subcommittee is engaged in revising these standards.

Both Detroit Edison Co and Public Service E&G have each sponsored development of new equipment for testing watthour meters. The Detroit Edison model makes full load, light load, and 50% power factor tests with a single revolution of the meter disc. Results are displayed by lighting up three decaded sets of tubes. The Public Service model, now being produced, uses the same principles, but test results are transferred automatically to a printed tape or punched card. All three tests take less than one minute.

LOAD RESEARCH COMMITTEE

Findings of a special committee studying load characteristics of electric house heating were highlighted in the Load Research Committee's report, presented by Chairman E. H. Schmidtman, Wisconsin Electric Power Co.

The study is based on data from a total of 69 homes in Baltimore, Detroit, and Milwaukee heated with radiant panels and 9 in St. Louis equipped with heat pumps. The study sought to provide electric companies with load data needed to guide policy decisions.

Highlights of the findings, as reviewed by Schmidtman, were these:

1. Composite average heating demand curves for the coldest week of winter showed two desirable characteristics: an 8 AM peak that gives considerable diversity from normal peaks, and a high load factor compared with other residential loads.

2. High coincidence factor, running from 72 to 82%, reflects the tendency of houses in the same area to demand heat at the same time.

3. Annual load factor of house heating is substantially lower than the diversified load factor of present residential customers, the study showed. It ranged from 18 to 25% for the houses studied.

The committee is engaged, with Middle West Service Co, in a nationwide survey of residential lighting. The survey, which involves direct measurement of residential lighting load, is intended to provide more reliable lighting load data than have been available.

In discussing a special committee paper on the potentialties of load research as an aid to utility management, Robert Ginna, president, Rochester Gas & Electric Corp, maintained that without a fuller knowledge of component loads that make up its business, utilities are riding for a fall. Lack of adequate load research has already cost untold millions of dollars, Ginna said. "We will have headaches enough after we have the facts provided by load research. How can we hope to act wisely without them," he asked.

APPLIANCE SERVICING COMMITTEE

Plans to hold a workshop conference for appliance manufacturers on the practical problems of appliance servicing were announced by W. H. Wagner, Wisconsin Electric Power Co, chairman of the Committee on Appliance Servicing. It is to be held in Detroit, Nov. 26-27.

The conference is a joint NEMA-AEIC project conceived to demonstrate to housewares and major appliance manufacturers some of the problems in making minor repairs. Objective is to encourage re-design of appliances to make servicing less difficult.

Utility appliance supervisors will demonstrate difficulties in making such simple repairs as removing lint from dryers, replacing fuses, and the time and trouble of replacing panel lights.

Leading appliance makers are being invited to send designers, service managers, and product people to the conference. Discussion following demonstrations will be focused on problems faced by manufacturers, distributors and dealers, and utilities with the aim of launching corrective action jointly through the NEMA-AEIC committee.

Interstate Power's Top Management Is . . .

Taking the Chance Out of Promotions

- Inexpensive, reliable method is developed to evaluate and select supervisors and managers on the basis of predicted job success
- Study helps pick the right man for the right job by determining characteristics of the company's successful managerial personnel

ROBB M. WINSBOROUGH, Management Consultant, and

JOHN J. FLAHERTY, Psychologist, Middle West Service Co, Chicago, Ill.

Appraisal of managerial personnel and identification and selection of able, promotable future supervisors and other management people has come to be recognized as an important part of forward-looking management policy.

Interstate Power Co, with headquarters at Dubuque, Iowa, has worked out a promising, practical solution to an important part of this problem.

Milton L. Kapp, Interstate president, and Ben F. Pickard, chairman of the board, recently authorized an organization and management study, part of which was:

1. A plan for determining characteristics of successful managerial persons within the organization.

2. Development of a method for selecting persons who would have a high probability of successful performance in specific key management jobs.

The plan was successful. As a result of the study, a method has been devised which reduces the element of chance in selecting employees who will prove to be successful supervisors and managerial employees. It also greatly reduces the likelihood of making a mistake in promoting an unqualified person.

The method is now applicable to evaluation and selection of present and future district and area managers, plant chiefs, district auditors, operating superintendents and assistant superintendents, business development supervisors, and service representatives.

The method can be extended and applied with high probability of success to additional positions in which there are sufficient employees to make a reliable sample and for which a sufficient number of qualified raters can be identified.

How the Study Was Made

Two problems in a study like this are:

1. How to get a reliable ranking of the relative performance of present managerial incumbents?

2. What psychological or other tests produce measurements bearing consistent relationship to relative job performance as reported by the ranking system?

With Interstate cooperation and help Middle West Service Co worked out a satisfactory, economical procedure for ranking job performance of present employees in key jobs. The method proved statistically reliable and had objective validity. This made it possible to use the job performance rankings as the yardstick against which psychological test results could be compared.

For reliable ranking, it is essential to have enough different individuals in identical jobs to provide a sample of not less than six people. Larger samples are preferable.

In electric utilities certain jobs have a high degree of general uniformity wherever they are found. Within a particular company the uniformity is very marked. Individuals in these comparable jobs can be ranked according to the way they perform over-all duties by ranking them separately on a variety of specific performance factors which enter into successful over-all performance of the job (see box).

The technique is to break down the job into a number of separate, independent factors. The next step is to find a sufficiently large group of

Factors Used in Ranking Interstate Power Co. Managerial Job Performance

1. Safety
2. Employee relations
3. Resourcefulness, ingenuity
4. Customer, public relations
5. Regularity on the job
6. Housekeeping
7. Correspondence, reports, paper work
8. Sales activity
9. Control of expenses
10. Budget control
11. Collections, delinquent accounts
12. Maintaining service, maintenance of distribution system, transmission systems, and substations
13. Training office employees
14. Employee meetings
15. Carrying out community development programs
16. Supervision of stores
17. System planning
18. Show windows, sales floor displays
19. Dealer relations
20. Power plant equipment maintenance
21. Power plant safety meetings
22. Merchandising profit
23. Sales promotion expense control
24. Initiative, drive, ambition
25. Merchandise inventory control
26. Achievement of employee participation in sales
27. Power plant operation

qualified people who know enough about both the job and the men to rank job occupants from most effective to least effective in performance on each factor.

How Ranking Was Done

A list of factors, judged to be of importance in job performance, were selected which were applicable to a broad range of jobs. Specific factors were included to cover performance in highly specialized jobs.

The 27 job factors selected were (1) meaningfully related to performance and (2) ones on which persons doing the ranking were capable of expressing a valid judgment as to job performance by present employees on each factor.

When well-qualified, experienced men are asked to rank a group of men whom they know on job performance on each of these factors, they can do it with a good deal of objectivity. People selected as rankers, or raters, knew the individuals they were ranking sufficiently well to place them in rank order on all, or nearly all, of a job's factors.

To rank key people in operating districts, rankers were selected from among general office officials and department heads. Top operating district people ranked second level district personnel within the district.

The smallest number of rankers used in rating relative performance of incumbents in any one job was four, and seven was the largest number. Each was supplied with names of men to be ranked, on separate 3 x 5-in. cards, one name to the card. This made it easy to sort names into rank order of performance on each factor.

Rankers were given a set of factor ranking sheets (see box). A set of instructions provided for forced-choice distribution of employees on each factor. Each rater would take a sheet and cards containing names of the men to be ranked. He then took the first two cards and put them in the order of the better man at the top and the less able man beneath. The third card was compared with the first and second and placed in its proper place. By repeating this process, all men were compared first as paired comparisons, then ranked into a forced distribution from the best to the poorest on each factor.

An employee's final rank on a factor was the rank average assigned him by all rankers who rated him.

Average rankings on all factors were then consolidated. It is possible to apply different weightings to different factors if that is deemed desirable. In the first Interstate study all factors have been included at the same weight.

The final result is a rank order of job performance in which names of all incumbents in a job appear in order of relative success in over-all performance. This is then divided into the upper half and the lower half.

The next step: Find out personal characteristics which distinguished the upper half from the lower on a performance basis.

To do this, a battery of four standardized psychological tests was used. Administration required about three hours per man. These measured mental ability, temperament factors, vocational interest, and mechanical comprehension. Eighteen separate measurements were collected on each of 130 employees in supervisory and managerial positions.

How Testing Was Done

Interstate, under the direction of Julius G. Schmidt, director of personnel, and Don G. Schroeder, assistant director, had been using psychological tests for more than ten years. They had collected large amounts of valuable, useful data. However, there were some gaps in it which they wanted to remedy. In addition, it was felt necessary to use a new, different personality-temperament test to check validity of previous Bernreuter test work.

A schedule was worked out by the personnel department for assembling key men in operating districts at predetermined times. Schmidt and Schroeder met with these groups and administered the tests.

A composite profile form was prepared. Scales were developed which equated raw test scores to percentile positions on the norms of the general male population for mental ability, personality-temperament, and vocational interests. On the mechanical comprehension test the norm for utility craft workers was used, and test scores were equated to the percentile scale of that norm. (Raw scores are not shown in illustrations.)

Individual profiles were drawn for

Ranking Sheet

For: _____
Classification

Factor 6: Housekeeping

A. Rank the men according to performance on this factor only. List the best performer on this factor as No. 1, the next best as No. 2, and so on down to the least satisfactory performer.

B. In ranking the men, consider only the following points which may apply to the job:
1. Cleanliness and orderliness of: a) offices; b) show windows c) storerooms; d) substations; e) pole yards; f) areas around company buildings.
2. Cleanliness and orderliness of power plant grounds, buildings, tools and equipment.
3. Maintenance and repair of buildings and equipment.
4. Maintenance and repair of company vehicles (paint, washing, greasing, etc.)
5. Cleanliness and maintenance of street lighting equipment.
6. Use and care of tools.

1. _____ 6. _____
2. _____ 7. _____
3. _____ 8. _____
4. _____ 9. _____
5. _____ 10. _____

_____
Name of Ranker

each individual tested. In addition, composite job classification profiles were drawn based upon the average score of all individuals in a particular job classification.

All individuals in each job classification were separated into those ranked in the upper half and those ranked in the lower half according to job performance. The range of scores and the average score of the upper and lower halves in each job classification were placed upon photographic transparencies through which individual profiles can be viewed (Figs 1 and 2).

This makes it possible to slip an individual test profile under the transparency which carries the composite profile of the upper and lower halves of all individuals now occupying that job. This makes it easy to see how each individual relates to the pattern of the better or poorer performers in a particular job classification.

Ratings Related to Test Results

The basic question which emerges in this sort of validation study is: "Do test results have any real, consistent, significant, and valid relationship to the way these individuals perform in their jobs?"

To get an affirmative answer requires that (1) performance ranking be real and valid and (2) there be a real relationship between rank on performance and rank on the tests.

In the Interstate study, rating scale reliability was determined through application of the recently developed statistical technique known as Kendall's Coefficient of Concordance. Rankings proved to be consistent and reliable. Differences in performance on the job, as revealed by rankings, were real differences, and differences found by various rankers manifested a high degree of internal consistency.

After ranking on job performance, individuals were then ranked in the order of their test scores on each of the tests and subtests. Correlations were calculated between rank on performance and rank on the tests and subtests as determined by the scores.

This was a severe test of relationship between performance on the job and scores on tests for two reasons:

1. Relatively small groups of employees in each of the key jobs meant one or two men could importantly influence the over-all picture.

2. All ranked and tested individuals were performing successfully as evidenced by their presence in the jobs. They were already highly preselected. As a consequence, the range of test scores was materially smaller than the range of scores would be from a general population sample. This meant that to reveal a meaningful relationship the rank order on the test scores had to be a rank order within a narrow score range that would parallel or approximate rank order of job performance.

It was found that there were meaningful relationships between performance on the job and performance on the tests.

Sometimes the relations were positive and sometimes negative; *i.e.*, good job performance was associated with high scores on some things and with low scores on others. Relationship significance also varied from job to job. For example, significance of a mechanical comprehension test score is very different for a plant chief and a business development supervisor. Likewise, significance of high persuasion interest differs for an assistant operating superintendent and a district auditor.

The range of scores was also indicative. Some jobs require a narrow range of scores on some test factors for success. Other jobs tolerate a wider range.

Minimum score levels were important for some tests in some jobs. For all jobs, some minimums seem

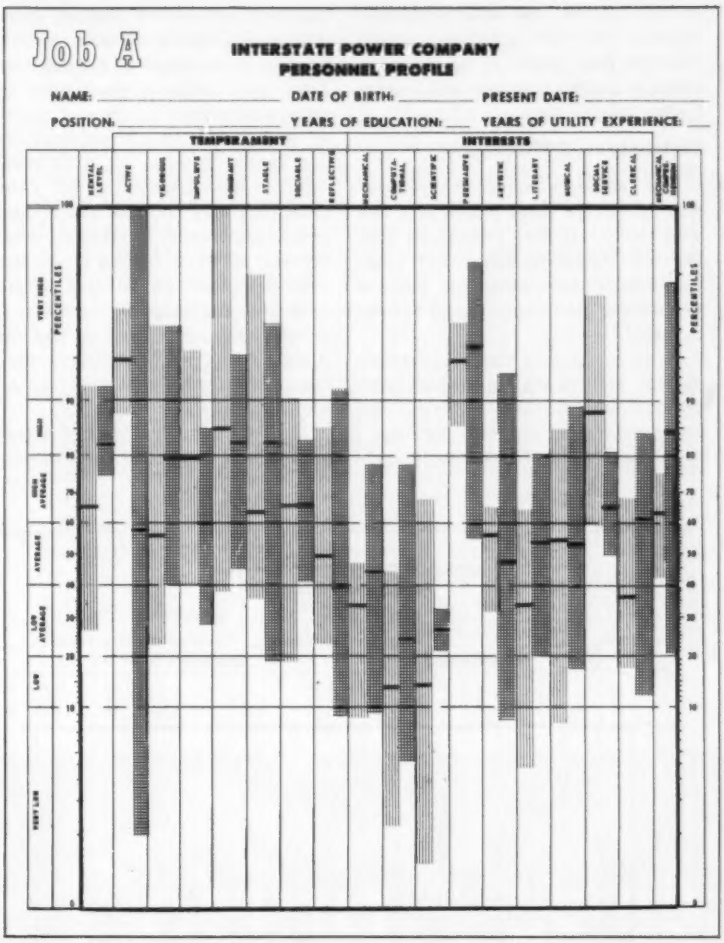


FIG 1—PARALLEL VERTICAL LINES show test score range of top half of all employees in this job, cross-hatched areas show less successful. Short horizontal, dark lines are average scores for better and lower halves, respectively. For success on this job, high activity, dominance and persuasion are essential; low interest in computational and scientific matters is an advantage. Too much mental ability and mechanical comprehension may be detrimental

to exist. These were established empirically in the Interstate study. Whether these prove to be the same limits in another company will require further investigation.

Rationale and Philosophy

The guiding principles of this study were, from the start, practicality and workability. It was recognized that all tests, rating methods, and ranking systems have limitations. None is perfect and perfection should not be expected.

At the same time they are effective devices for reducing guesswork and limiting and partially removing unconscious bias in personnel dealings.

In the present state of our knowledge any test battery and any rating system is doomed to some failures. But this is no reason to discard them. Tests and rating methods are developed to predict in terms of statistical probabilities on a group basis. We can expect them to be right seven, eight, or nine times out of 10. Other times they may fail. But this is much better than chance, or guessing, where five out of 10 is normal probability.

In this study we resolved to proceed from the things we were sure of to the things we wanted to find out. Among things we knew and assumptions upon which we relied at the start, we could list these:

1. Some minimum level of accomplishment is demanded for successful retention in every job. Therefore, there is a minimum level of mental ability (intelligence) which an individual must possess in any given job to have a chance to succeed. Below this, chances for success are too slim.

A minimum level of intelligence or some other trait is like leaping a chasm: You either make it or you don't. The amount by which you make or miss it is not too important. In setting minimums we are concerned with whether or not an individual can make the leap.

2. An individual may possess too much of a certain trait for successful performance in a particular job. At the same time a lesser degree of the same trait might be the right amount needed for success.

3. The foregoing two concepts lead to the concept of working with minimum levels and acceptable ranges as the limiting factors for predicting successful job performance.

4. Major factors related to job success are, in general, intelligence, personality or temperament traits, interests, skills, and aptitudes.

5. If we measure the above factors and determine the degree in which they are possessed by persons now successfully performing given jobs; and if we determine how less successful persons deviate from the successful pattern, we have a qualitative and quantitative basis upon which to predict probable job success of new people in each job for which this data has been developed.

6. If an individual has been successful in a given job, it is reasonable to expect he will prove successful in a similar job at a more difficult level provided he has not reached the limit of his indicated potentiality and meets the qualifications and the pattern of success associated with successful predecessors.

7. A forced-choice ranking system based upon job performance as assessed by competent, qualified rankers who knew the men and the jobs would discriminate more certainly between men in small homogeneous job samples than would a complex merit rating system of abstract factors.

The success of the method used in the Interstate study can be further perfected and extended to more jobs. Its application is not burdensome, and cost is slight in comparison to long-term benefits. A similar method can be developed for any company similarly organized and situated.

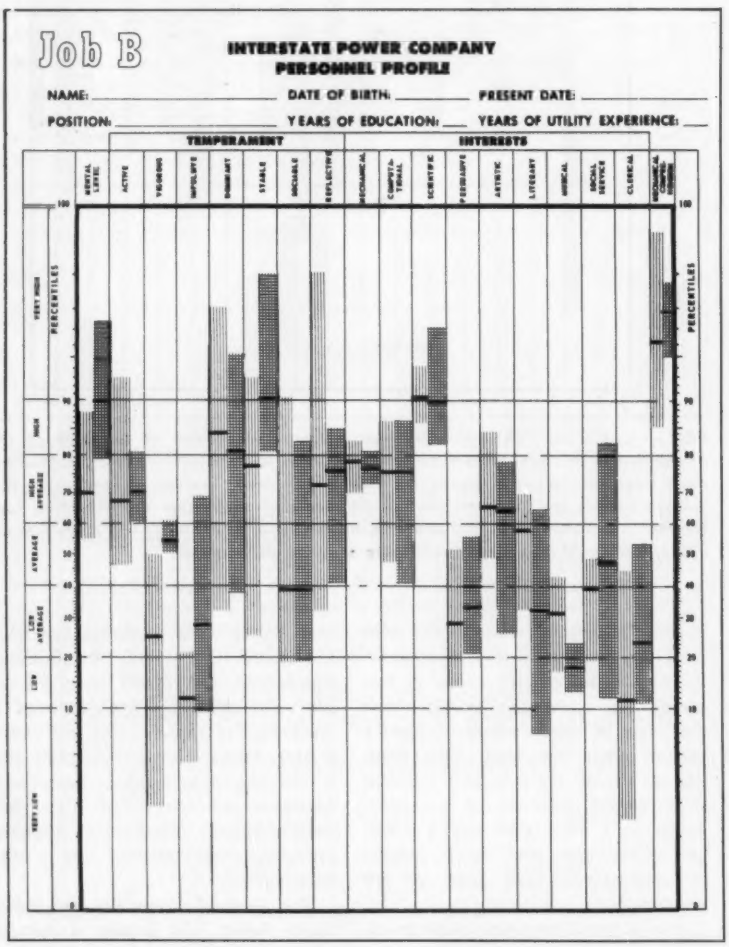


FIG 2—IN THIS JOB, HIGH DOMINANCE, high scientific interest, and very high mechanical comprehension are essential. As in Job A, too much mental ability may be detrimental. Better performers in this job are not vigorous people. Here, too, parallel vertical lines show test score range of top half of all employees in this job, cross-hatched areas show less successful. Short horizontal, dark lines are average scores for better and lower halves, respectively

A Special Report

DAN BRAYMER,
Assistant to the Editor

Today's toughest task for substation designers is evaluating and resolving the multitude of often-conflicting factors that have a bearing on layout and design.

Besides fulfilling its functional requirements, a modern substation must not only be economical in its use of space but in the interests of safety and reliability, it must also have adequate clearances to live parts. It must be practical to operate, maintain, and expand. Yet it must be low in cost.

Layout must be flexible—so that breakers, buses, and transformers may be taken out of service without interference to service or sacrifice to protection. On the other hand, the switching structure should preferably have a simple design requiring the minimum use of material.

Furthermore, the hazard of a direct stroke of lightning to an unshielded substation should be carefully balanced against the risk to a shielded substation from a broken shield wire.

Finally, today's substation should provide operators an unobstructed view of apparatus, yet still be pleasing to the public eye and have a sound level acceptable to the neighbors' ear.

These and many other factors bedevil today's substation designer. No single report can hope to resolve the many conflicts that exist. It is our hope that by presenting some ideas that are used to ease such problems, from Pennsylvania to the Pacific, a contribution may be made to the simplification and clarification of the problems of substation design.

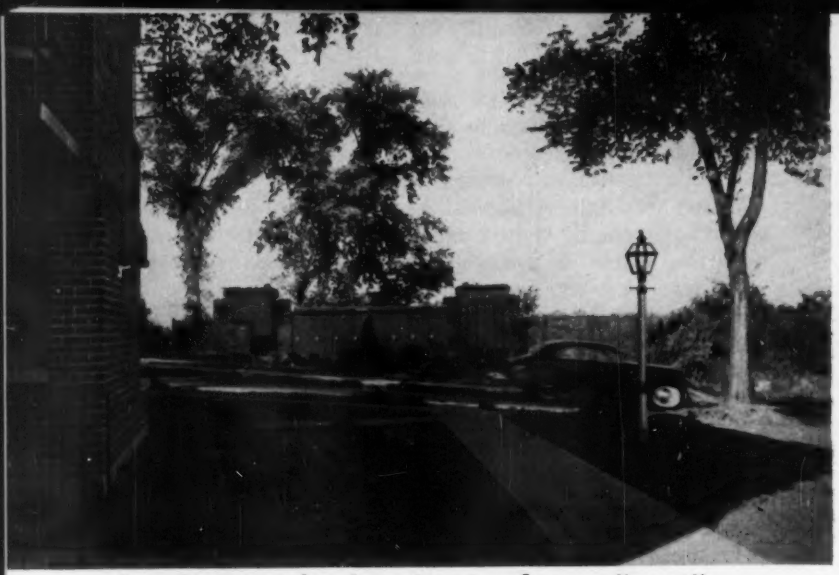
Modern Design Eases Substation Problems

In This Report . . . .

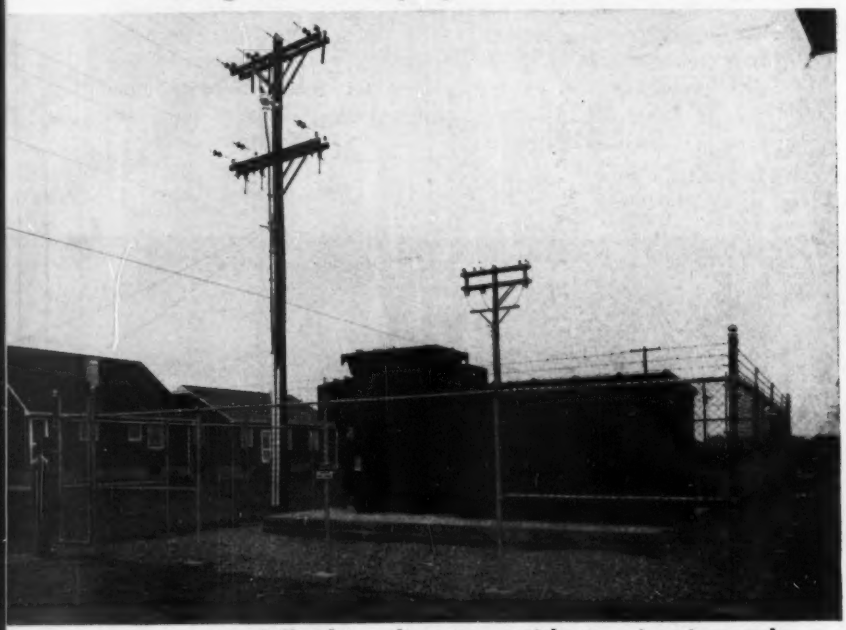
Substation Design Meets Many Exigencies . . . . Page 82
An Easy Check on Shielding Design . . . . . Page 85
Fit Substation on Cramped Site . . . . . Page 86
4 Design Features Cut Substation Costs . . . . . Page 90
Reclosers on Feeders Pay Off . . . . . Page 93
Steel Ground Networks Cost More . . . . . Page 94

Substation

MILES MAXWELL, Electric Utility Engineer, Westinghouse Electric Corp, East Pittsburgh, Pa.



For designer, landscaping is often a "must" . . .



. . . space difficulties dictate outside terminating pole . . .

. . . or unit design which also saves erection time

Substation design today must reflect not only requirements within the station itself but also those imposed by transmission and distribution system expansion to serve mounting loads. Predictions that loads will double and triple in the foreseeable future have forced many utilities to take a long look at substation designs. Decisions will be shaped by their answers to basic questions like these:

1. Are present subtransmission and primary feeder voltages the proper ones for the next ten or 20 years?

2. Are present maximum size substations large enough?

3. Can substations of present design be erected in an established area without excessive complaints?

4. Are present designs proper for easy and least expensive expansion?

Sites Scarce and Costly

In commercial areas substations are occupying land whose value is increasing greatly. More locations for substations are difficult to acquire. In residential areas, no one wants to live next to a substation and public relations are becoming more and more important.

The overall objections are generally less if an existing substation is expanded than if an entirely new substation is erected in an established residential area.

Subtransmission and primary feeder voltages can have major effects on substation design but do not, in general, affect the type of substation. Standardized designs allow for subtransmission voltages up to 69 kv. Designs are available for higher voltages. Primary feeder voltages up to 15 kv can be handled in standard designs.

Equipment cost is not the only economic consideration in substation design. Engineering, erection, maintenance, land, and appearance improvement are all important factors.

There are three general types of substations to consider: **Unit, coordinated, and conventional.**

Numerous factors must be considered in selecting one of these. Where appearance is a ruling factor

Design Must Meet Many Exigencies

the unit substation is generally used. Even though primary feeders and subtransmission circuits are open wire, it is possible to terminate them some distance away from the substation and have all circuits enter underground. This gives a neat appearance with all live parts behind locked steel doors. Landscaping can make the substation even more suitable from the standpoint of appearance. A unit of this type, shown in photo at top of opposite page will eventually be almost completely hidden by landscaping already in place.

The unit substation consists of a CSP power transformer or outdoor metal-clad switchgear with throat-connected transformer. Primary feeder breakers are of the draw-out type and may be either air or oil. Primary feeders usually leave the station in underground cables. Subtransmission may be either overhead or underground.

Installation of such a station is quite simple. The unit substation portion is shipped in one or more large sections, and setting it on a level concrete slab is all that is required. Connection of substation sections and incoming and outgoing circuits completes the installation.

A coordinated substation is a unit substation with associated terminating equipment for subtransmission. This terminating equipment consists of the steel structure, circuit breakers if used, disconnect switches, lightning arresters, and all other associated equipment. The coordinated substation is a complete substation. The middle photo on the opposite page shows a unit with its terminating equipment right outside the substation fence. The bottom photo shows an installation in a residential area.

Erection Time Can Be Cut

Coordinated substations are designed for minimum erection time. The unit substation portion is erected by simply setting it on a pad and making connections. The steel structure and associated equipment are shipped so as to facilitate assembly. The unit or coordinated substation using metal-clad switchgear has the following advantages over conventional substations.

1. Neater appearance.
2. Easier to maintain.
3. Shorter erection time and simpler erection.
4. Less engineering time required of the user.
5. Smaller land area required.
6. Simple expansion.

At first glance the unit or coordinated substation may appear to have a cost disadvantage because the equipment itself is usually somewhat higher in cost than conventional substation equipment. But many companies have found that when all costs, such as land, engineering, and erection are considered, the unit substation is the most economical. And where appearance is important or built-up areas create problems in finding new sites or room to bring out a sufficient number of primary feeders, unit substations may cost considerably less than conventional ones.

Standardization Breeds Benefits

To obtain the full benefits of unit and coordinated substations, the user must standardize his substations as much as possible. If he uses a lot of engineering time in making every substation special, he loses some of the advantages of unit-type equipment. If he standardizes on a few transformer sizes with a definite plan for expansion and decides on definite relaying and control schemes, future substations should require little engineering. Some users have carried this to the point where unit substations are ordered for stock.

Conventional substations usually include an outdoor steel structure with outdoor oil circuit breakers. Usually the user acts as prime contractor, ordering and coordinating shipment of individual items used in the substation. The steel structure may or may not be of more or less standard design. Several manufacturers offer conventional substations as a package. Considering equipment cost only, the conventional type substation is usually the most economical whether the user acts as prime contractor and designer or buys the substation as a package.

Primary feeder positions in the conventional substation usually contain outdoor oil circuit breakers. In metal-clad switchgear either oil or air breakers can be used. In some cases, such as badly corrosive atmospheres, oil breakers are recommended, but generally air breakers are used. Advantages of air breakers are:

1. Less fire hazard.
2. No oil handling equipment required.
3. Simpler and less expensive maintenance.
4. Easier inspection of breakers.

Metal-clad gear offers an additional advantage over conventional substation design. The spare breaker may be used to replace a breaker for maintenance with minimum down time on the feeder and no loss of feeder protection.

For several years there has been a decided trend toward automatic or remotely controlled substations. They are generally more economical when all factors are considered. In automatic substations automatically performed functions, such as reclosing and voltage regulation, may be faster and more reliable than when performed by an operator. Remote control places control and the indication of some, if not all, system conditions under the system dispatcher for more reliable and efficient operation particularly under emergency conditions.

Automatic substations usually have automatic reclosing on breakers. Any high voltage breakers have relays. Probably they have means of transferring from a dead to a live circuit with circuit breakers or disconnect switches if more than one subtransmission circuit is provided. And voltage regulators on the bus or feeders are automatically controlled.

Remote Control Features

A remote controlled substation may have a number of automatic features. It is common practice to use reclosing relays on the feeder breakers, but most companies use only one reclosure. Bus voltage regulation is generally automatic but may be remotely controlled. Any of the other automatic features may be accomplished manually by remote control. Control and indication is usually provided at the control point for every breaker position. Subtransmission transfers with disconnect switches or breakers may also be remotely accomplished.

Most remotely controlled substations on other than radial subtransmission

have telemetering of some functions. This telemetering may range from bus voltage or transformer tap position to complete telemetering of kilovars and kilowatts on all incoming and outgoing circuits. For loop substations telemetering of the high-voltage circuits is fairly common. And a tie to another system at a remotely controlled substation is practically always telemetered.

The type of communications channel to be used for substation control seldom gets the amount of engineering attention it deserves. As load densities increase and more remotely controlled substations are installed, there may be more communication channels associated with substations and subtransmission than with power plants and transmission. There should be long-range planning in the communication system as well as in other phases of the power system.

Four types of channels are used today for transmitting, controlling, indicating, and telemetering between the control point and the controlled substation. These are pilot wire, telephone carrier, power-line carrier, and microwave radio.

In some cases, it is possible to make a free choice between any one of the four. Where the number of channels is small and distances are not too long, pilot-wire circuits are often used. If pilot-wire channels can be used, telephone carrier is seldom considered. But distance limitations on use of pilot-wire circuits may require telephone carrier if leased channels are used.

THIS SUBSTATION has microwave communications with multiplexing equipment to give two supervisory, four telemetering channels in addition to voice channel

Channel Requirements

Supervisory control and selective telemetering can usually be accomplished over one telegraph or voice communication channel. Of course, if continuous telemetering is desired, one channel is needed for each continuously telemetered quantity. These channels can be separate pairs of pilot wires or equivalent, or they can be channels derived from the use of voice frequency carrier tone equipment on a single pair of wires.

Pilot-wire circuits may be owned by the utility or leased from others. Telephone carrier is most often on a leased circuit.

In general, if only one channel is required for supervisory control and selective telemetering, one of the two telephone-type wire lines or power-line carrier will provide the most economical solution. If continuous telemetering of several quantities is desired, economics generally indicate either power-line carrier or microwave radio. If more than about five channels are required, microwave radio provides the most economical solution in most cases.

Evaluation of initial cost does not greatly influence the choice of channel type in many cases. There may be no frequency available for power-line carrier or system configuration may be such that a reasonably clean path for power-line carrier is not available. Past experience with leased or utility-owned pilot wire may influence the decision on these types of channels more than cost.

Microwave Builds Reliability

Microwave can represent the ultimate in reliability and independence from external disturbance factors; these factors, plus having a communication system completely under control of the utility, are difficult to evaluate. The number of channels required in some cases makes microwave the most economical method but the choice is seldom that simple. Failure to have a clear-cut, flexible plan for development of the communications system can result in higher over-all expense and less efficient operation in the long run.

Balloon and model provide . . .

An Easy Check on Shielding Design

A. C. GOHLKE, Director of Electrical Engineering, Cleveland Electric Illuminating Co, Cleveland, Ohio

A 20-in. balloon with a 1-in. : 50-ft model of a substation or transmission line are all the equipment required to test the adequacy of direct-stroke shielding. If, when the balloon is placed in contact with the model, the "grounded" parts of the model prevent the balloon's surface from contacting a "live" conductor by a reasonable margin, direct-stroke shielding has been provided in the design.

Of course this method of determining the adequacy of direct-stroke shielding is proposed only to illustrate the principles of measurements which are to be made mathematically.

The center of the 20-in. balloon represents a storm cloud with an effective height of 500 ft above ground. The 500-ft height is considered to be a conservative value as a result of the 1935 to 1941 Pittsfield investigation which revealed that the greatest number of strokes had a height of 2,000 to 7,000 ft above ground and that 99% of the strokes to ground had a length exceeding 500 ft.

As the cloud approaches the transmission line, there is a lateral zone, depending upon the height of the structure above ground, where side strokes can take place from cloud to structure rather than from cloud to earth. The angle of the side stroke as the cloud enters this lateral zone will be the most difficult to shield and is considered as the critical angle. It will be observed that the critical angle of the side stroke varies with structure height, becoming more acute as height increases.

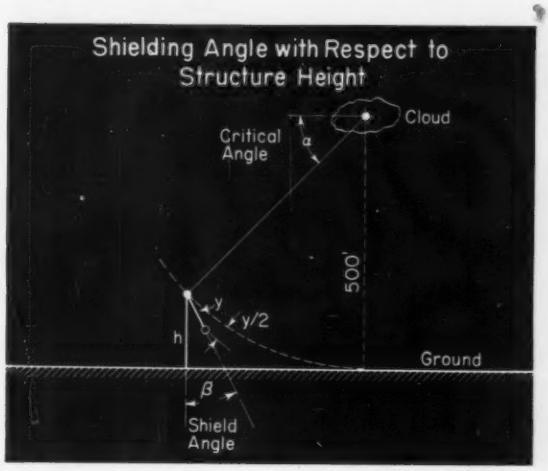
When the cloud is above the structure, the strokes are almost certain to take place between cloud and structure at an angle most favorable from the standpoint of vertical shielding.

For this reason, it can be shown that if the direct-stroke protection is adequate for the "outside" conductors of a structure, it will in most cases prove more than adequate for the inside conductors.

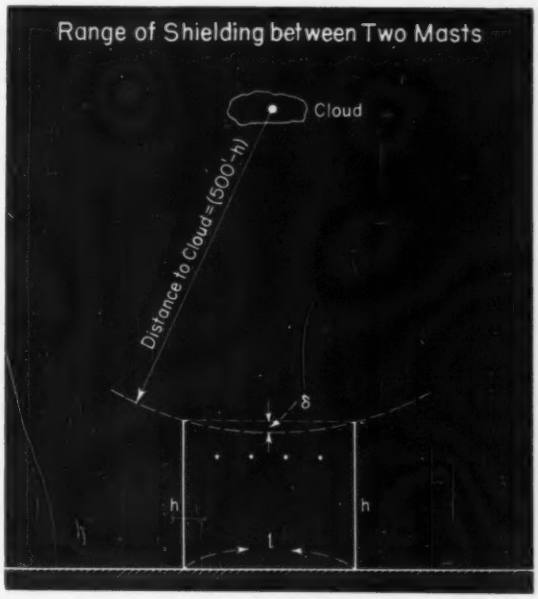
It is quite possible that normal pole lines equipped with ship type masts on each pole can be shielded adequately from direct strokes and that the shielding efficiency of tower lines with single ground wires can be substantially improved by the installation of side masts extending outward from the top crossarm of the tower structure.

When direct stroke shielding is incorporated into the design of structures or lines, it is recommended that the stroke distance from cloud to mast or shield wire be less than the distance from cloud to "live conductor by an amount which is at least equal to the impulse sparking distance of the insulation used."

High shielding efficiency is necessary if good lightning performance is expected. Shielding failures are almost certain to result in insulation flashovers while a reasonable amount of insulation can be protected from flashover when the stroke current is absorbed by a well-designed grounding system.



h = Height of structure ft	Critical Stroke Angle α	Shield Angle to conductor β
0	90°	60°
50	64°–10′	34°–10′
100	53°–10′	23°–10′
150	44°–30′	14°–30′
200	36°–50′	6°–50′
250	30°	0°



Values of "δ" for various spans "l"

l-ft	h = 50 ft	h = 100 ft	h = 150 ft
50	0.70	0.78	0.89
100	2.78	3.14	3.57
150	6.25	7.05	8.0
200	11.0	12.6	14.2

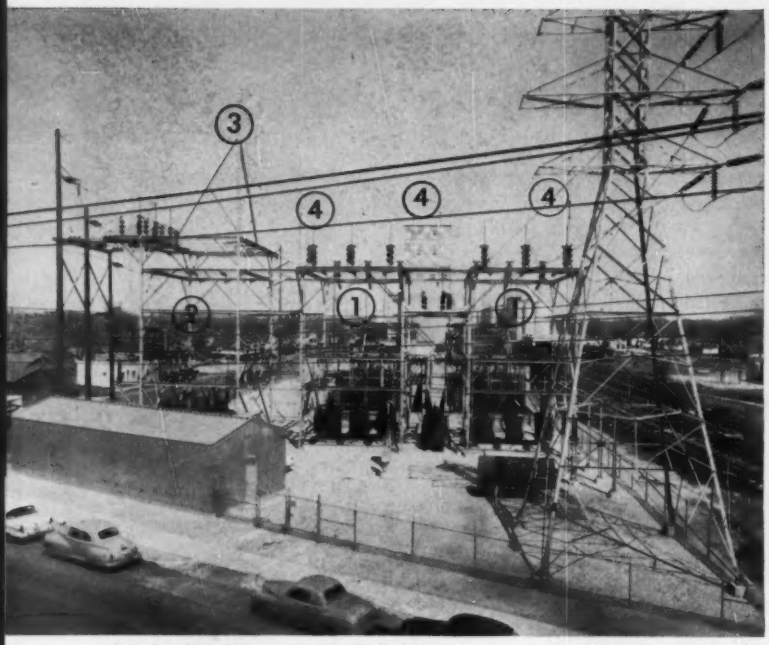


FIG 1—SPACE was so limited designers were compelled to reduce the 115-kv bays from the conventional 30-ft width to a width of 26 ft and 6 in.

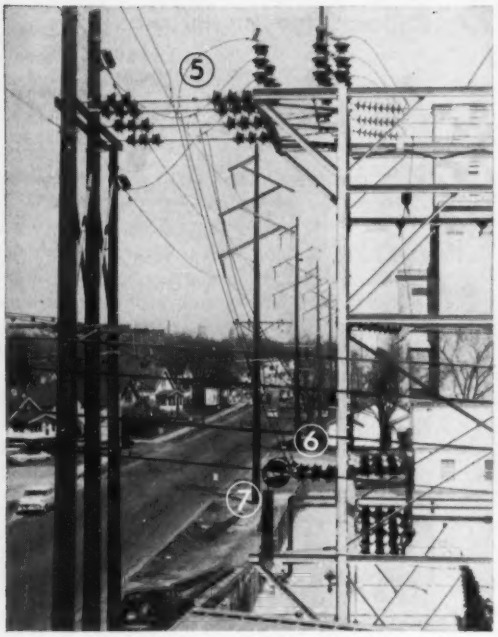


FIG 2—RIGHT-ANGLE TAKE-OFF for 115-kv line in 23 ft, inability to guy were problems

Fit Substation on Cramped Site

These provisions pictured above solved problem:

1. Width of 115-kv bays was reduced from 30 to 26½ ft and structure height increased to compensate
2. One 115-kv line bay has 3 levels of strain buses. Starting from breaker terminal height and using 8 ft interphase spacing, height was held to 54 ft
3. Cut in bay width left only one column far enough from switches to allow extension and bracing for shield wire termination. Both transmission line shield wires go to it
4. Bayonets atop 3 column extensions complete direct-stroke shielding of the substation
5. Line dead-end structure was "bolted" to substation steel by insulated spacers where guying was impracticable
6. Horizontal stack of high-strength insulators outrigged from station steel support carrier wave trap
7. Coupling capacitor was bracketed to steel to save space
8. Copper-tube outriggers on some switches train cables where stranded conductor wouldn't keep clearances
9. Bus tie bay width cut from preferred 20 to 17 ft. Controlling factor was 5 ft minimum distance between switches
10. Size and interphase spacing of aluminum reactors on feeder fixed minimum 13.8-kv feeder bay at 15 ft

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L. C. WEBER, Electrical Engineer, Northern States Power Co, Minneapolis, Minn.

Designers faced a tough task in assembling electrical and structural elements in scant space and in meeting difficult line take-off conditions at Northern States Power Co's Southtown Substation.

This substation was designed for an ultimate firm capability of 125,000 kva with three transformer banks, each rated 37,500/50,000/62,500 kva with 27-13 kv feeders and three incoming 115-kv circuits. But initially it will consist of two transformer banks, 12-13 kv feeders, and three incoming 115-kv circuits.

Two 115-kv lines approached the station along a railway right-of-way and entered the property over a heavily traveled street (Fig 1). Clearance over the street and the railroad required a double-circuit dead-end tower and that the lowest conductor be 50 ft above grade.

The third 115-kv line approached from the opposite direction on pole

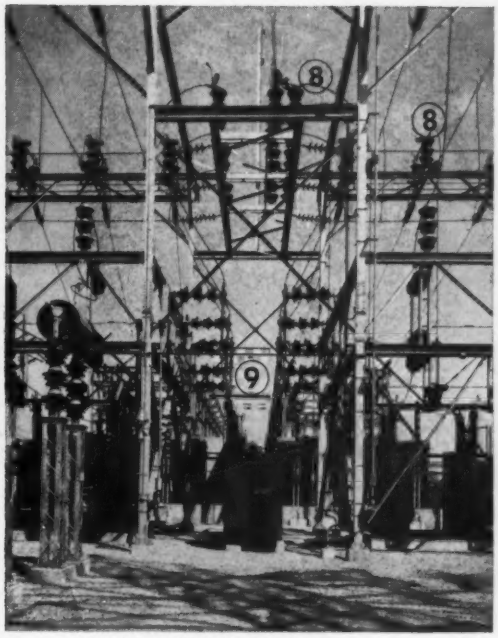


FIG 3—MINIMUM DISTANCE between switches determined distance between the steel uprights

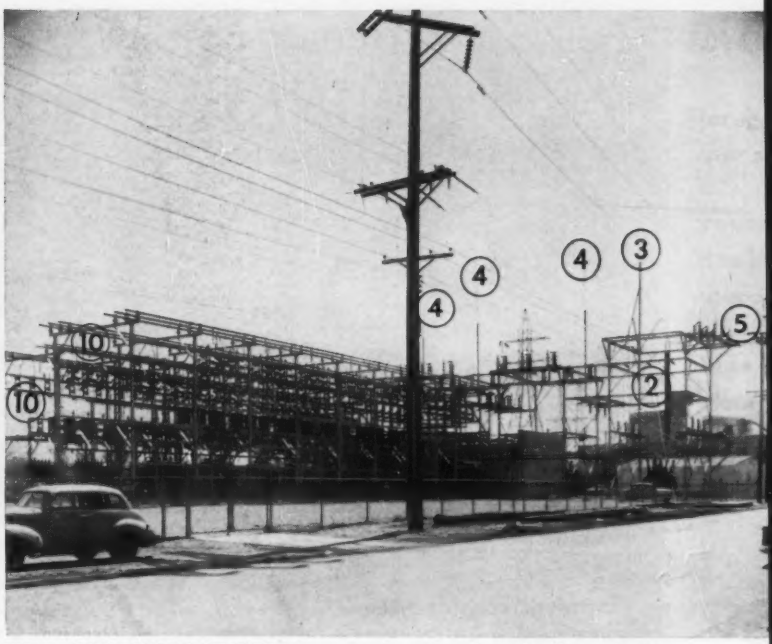


FIG 4—TWO LINE SHIELD WIRES were terminated on braced column; three unbraced columns were extended and equipped with 15-ft pipe bayonets

structures just inside the east curb line of another main traffic artery. Its entrance to the 115-kv station structure required a sharp right angle take-off in 23 ft (Fig 2).

Because space did not permit guying the dead-end structure at right angles to the line, this situation required a special design.

Instead of guys, support for this terminal structure became the unorthodox set of separators shown (Fig 2). Each consists of a 1½-in. galvanized pipe with flanges welded to each end. The separators, mounted between the poles and structure on 115-kv bus supports, provided insulated supports to train the conductors. An additional separator was required for A phase to carry the lead down to the carrier-current wave trap and back to the line oil circuit breaker by pass switch.

Termination of the double-circuit 115-kv line presented no particular problem. Its terminal tower fitted neatly into the wedge-shaped corner of the property. Its conductors were slack spanned into the structure. As the line conductors were in a vertical configuration at the dead-end tower, the CAB phasing, top to bottom, was rolled out to the ABC, east to west, substation phasing. The generous height of the tower helped considerably with this problem.

Carrier traps and coupling capacitors for these two lines were mounted on stands at ground level where they would be accessible for tuning and checking. Thus climbing was eliminated. But limited space prevented handling the trap and capacitor for the north line in this manner. As a compromise, this wave trap was supported from the steel structure using horizontal, high-strength insulator stacking units (Fig 2). The capacitor was mounted on a bracket from the structure column.

A height of 22 ft for live parts was selected. This provided aisle clearance for personnel and equipment below the coupling capacitor bracket and complied with standards for public safety, as equipment very nearly overhung the fence beside the public sidewalk.

Design 115-Kv Section

Southtown's 115-kv structure required three line-terminating bays and two bus-tie positions (Fig 1). Space for it was only 134 ft wide. To fit it, width of the standard 30 by 34 ft, 115-kv line structure was reduced to 26½ ft by cutting phase-to-phase and phase-to-ground spacing to a minimum of 8 and 5½ ft, respectively. Height of the structure was increased slightly above the standard 40 ft to secure clearance where conductors were carried through column rows to disconnecting switches.

Copper tube outriggers were used on some switches to train cables where clearance could not be maintained using the stranded cable conductors. The preferred 20-ft bus-tie bay width was reduced to 17 ft. The controlling factor was the 5-ft minimum clearance required between live parts of the breaker isolating disconnect switches (Fig 3). Double-blade, side-break switches were used for these units.

Switches required to break charging or parallel current were horizontally mounted, single-blade, vertical-break units. Clearance to structure cross bracing for the line bays housed in 26 ft 6-in. wide structures required vertical break switches vertically mounted for breaker isolation. All switches are group operated.

Structures for the two lines with south take-off are 46 ft high. The line bay at the west end of the 115-kv structure has three levels of strain buses, requiring a structure height of 54 ft. In each case the starting point was the breaker bushing terminal height. Disconnecting switches were placed so that the conductor from the switch to the breaker bushing terminal was approximately horizontal.

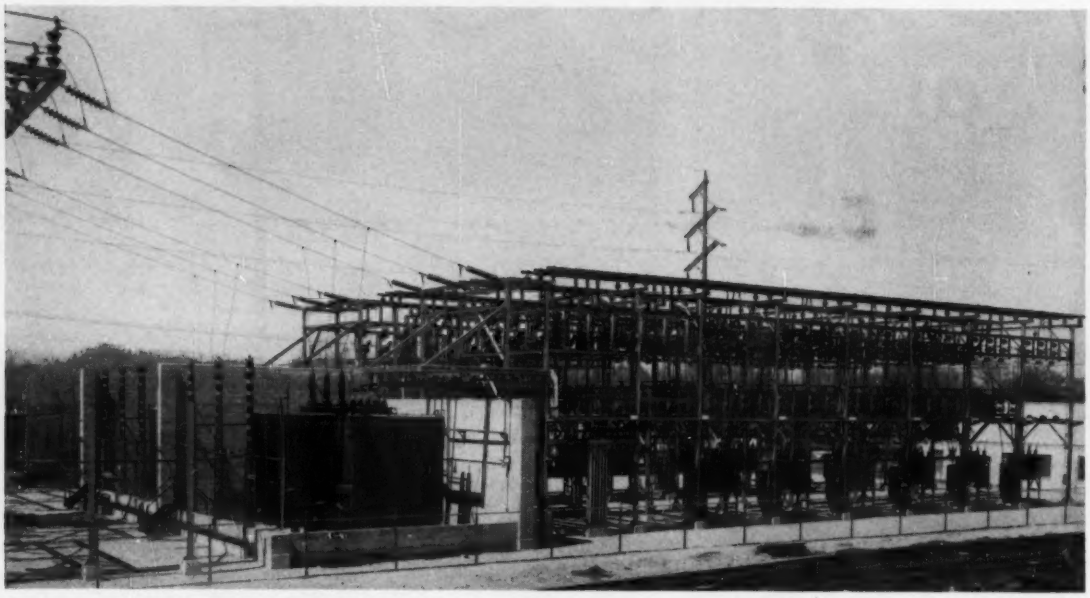


FIG 5—LOW-VOLTAGE SECTION (right) had to be compressed into an area 134 by 240 ft. Design is for an ultimate complement of 27 13-kv feeders, although the initial installation consists of only 12 13-kv feeders, as article explains

Hence, the level of strain buses was worked out using a minimum of 8 ft for interphase spacing. These were the determining factors in arriving at the structure heights.

All bus conductors are 500-MCM copper. Insulators are 10-in. discs, nine per string. All bus supports and switch insulators are 5-in. bolt circle cap-and-pin standard strength units except for the wave trap support.

Current measuring requirements were provided by bushing current transformers at the breakers. All potential requirements were provided by potential devices either on the oil circuit breaker or the carrier coupling units.

With the 115-kv structure occupying 113½ ft of the total width, the remaining 20½ ft were divided into 7 ft on the east and 13½ ft on the west end of the structure. Fences were placed 6 in. inside property limits, leaving aisle spaces of 6½ ft and 13 ft. Fence gates and driveways were provided so that no major equipment would have to be moved through the 115-kv structure.

Shield Wires a Problem

Shield-wire termination became difficult with the reduction in bay width. Normally, a 20-ft column extension with angle braces provides the shield wire terminal. In this case, because of the reduced widths, only one column was sufficiently removed from switches to allow extension and bracing. Accordingly, both line shield wires were carried to this one column and provided good coverage for the lines and the west half of the 115-kv structure (Fig 4).

To complete the shielding, one column was supported on the centerline of each bus-tie bay and on the east face of the east line bay. These three columns were extended 20 ft above the top beam. Extended above the tops of these columns were 15-ft pipe bayonets.

LV Section Compressed

The low-voltage units were compressed into the remaining 134 by 240 ft (Fig 5). Each of these consists of a 62.5-Mva 3-phase bank, its circuit breakers, bus-tie position, and nine feeders. Boundary conditions here were almost as severe as they were in the high-voltage portion of the project. The controlling element in feeder bay width became the reactors (Fig 6). Price and availability indicated that aluminum reactors were likely. Designs were based on 500-amp, 4% reactors as the maximum for each feeder. Physical size and interphase spacing of these reactors were such that 15-ft feeder bay width was the minimum.

Basic design was a double-bus, single-breaker scheme (Fig 7). Buses have a capacity of 3,000 amp. They are expected to withstand short-circuit stresses of 1,000 Mva. The basic impulse level throughout the section is 110 kv. All feeders were laid out as shown (Fig 6). Each feeder was provided with reactors. Space was provided for a 3-phase, 750-kva, 10% regulator on each feeder in case they become necessary in the future.

Switching was provided so that one bus could serve as a transfer bus for breaker servicing. The feeder reactors for each line remain in normal service during operation using the transfer bus.

All feeders leave the station underground and have cable disconnecting switches with grounding blades. Each feeder is capable of bifurcation with separate cable switches for each set of cables.

Arresters Necessary

Past experience indicated that arresters were necessary on underground feeders to avoid flashovers. Waves on lightning and switching surges reflected by the reactors are the background causes for this requirement and the 3-conductor pothead is the weak link in the chain.

A fault ground system requires bus fault protection. Phase-to-ground

fault current, flowing to the structure and a current transformer to ground, is detected by relays which trip all breakers in the associated bus section. The arrester grounds and the ground connection to blades of the cable disconnect switches, as well as the pothead, are outside the ground fault zone.

Station Is Unattended

Control and metering equipment are mounted on standard panels in a prefabricated, sheet-metal control house. The house is completely insulated and provided with forced ventilation. Lighting consists of rows of fluorescent fixtures hung from the ceiling behind as well as in front of the panels. Control and metering circuits were brought in underground and terminated in metal cabinets. The indoor circuits were carried in wire troughs, eliminating numerous expensive conduit runs. The battery and charger are located here, together with a desk for the use of operating personnel.

The station is unattended, having been provided with automatic and supervisory control.

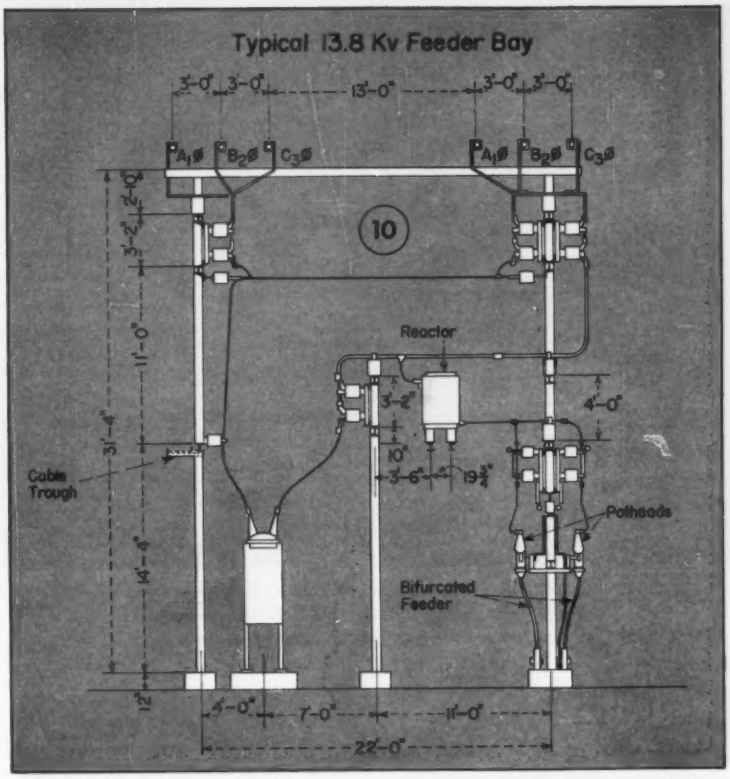


FIG 6—SIZE of 500-amp, 4% aluminum reactors determined 15-ft feeder-bay width. Reactor will remain in service even when feeder is served from transfer bus

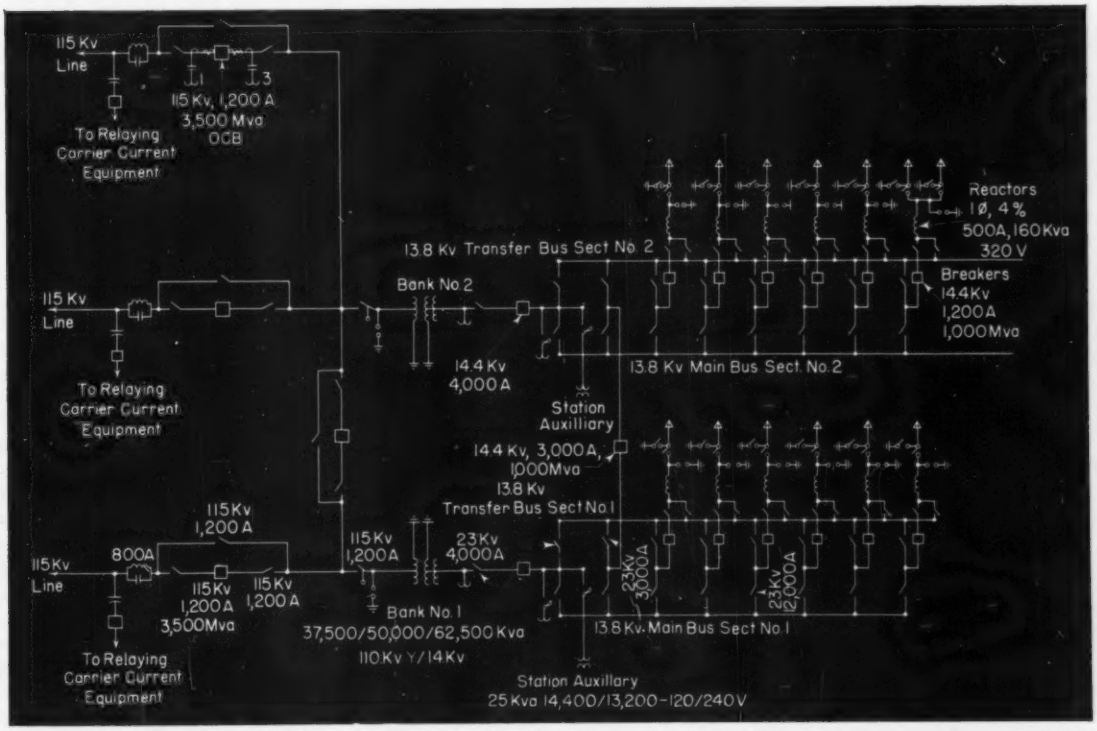

115 Kv Line
115 Kv, 1,200 A 3,500 Mva OCB
To Relaying Carrier Current Equipment
Reactors 1ø, 4% 500A, 160 Kva 320 V
13.8 Kv Transfer Bus Sect No. 2
Bank No. 2
Breakers 14.4 Kv 1,200 A 1,000 Mva
14.4 Kv 4,000 A
13.8 Kv Main Bus Sect. No. 2
Station Auxilliary
14.4 Kv, 3,000 A, 1,000 Mva
13.8 Kv Transfer Bus Sect No. 1
115 Kv 1,200 A
800 A
115 Kv 1,200 A
115 Kv 1,200 A
115 Kv 1,200 A
23 Kv 4,000 A
23 Kv 3,000 A
23 Kv 2,000 A
3,500 Mva
Bank No. 1
37,500/50,000/62,500 Kva
110 Kv Y/14 Kv
13.8 Kv. Main Bus Sect No. 1
Station Auxilliary
25 Kva 14,400/13,200-120/240 V

FIG 7—BASIC DESIGN was double-bus, single-breaker scheme for 3 transformers, 3 incoming 115-kv circuits, 27 13.8-kv feeders. Initial installation was for 2 transformers, 3 115-kv circuits and for only 12 of the 13.8-kv feeders

DUWAMISH SUBSTATION is designed to serve 32 26-kv feeders from four 75/100/-125-Mva. 230/26-kv transformers under the ultimate plan. Four 14,400-kvar, 26-kv banks of capacitors are arranged so capacity of each may be doubled

4 Designs Features Cut Substation Costs

These design features cut cost at Duwamish substation:

- Aluminum structures and conductors for 26-kv bus
- Control tunnels under 26-kv bus sections
- Direct-burial control cables in 230-kv switchyard
- Supervisory control for 495-Mva installation

H. V. STRANDBERG, Chief Engineer,
R. L. SKONE, Senior Engineer, Dept. of Lighting, Seattle, Wash.

Aluminum structures and buses on the low-voltage side of Seattle City Light's 230/26-kv Duwamish substation were important in lowering installation, operating and maintenace costs. Another design feature contributing to lower costs is common tunnels, under the 26-kv bus sections, which house cubicles for instrumentation, relaying, and control. On the high voltage side, direct-burial control and relay circuits, and tubular aluminum bus help hold the line on installation cost. And unattended operation of the 495-Mva (ultimate) substation through supervisory control will permit operating economies.

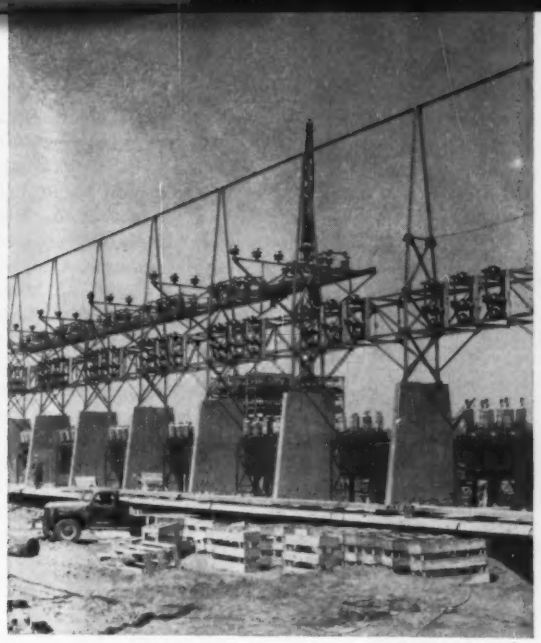
Duwamish substation is a major component of a transmission and distribution expansion program which is running concurrently with long-range plans calling for the addition of 687 Mw of generating capacity. Power is delivered to the substation over two 230-kv lines, one originating at South substation and the other at Bothell substation. These substations are supplied over City Light's 230-kv transmission system from its hydro plants and interconnections with the Bonneville system.

The lines terminate on a four-position 230-kv ring bus which feeds two 75,000/125,000-kva, 230/26-kv 3-phase transformers. Each transformer supplies a 26-kv bus equipped with eight 26-kv feeder positions, two 14,400-kva capacitor positions, and bank and bus-tie breakers. The substation is designed for unattended operation with supervisory control of the 230-kv circuit breakers, selected 26-kv feeders which supply important industrial loads, and the capacitor breakers. In general, the supervisory control will override automatic reclosing. All other 26-kv feeders have automatic one-shot reclosing, as have the 230-kv line breakers. No reclosing of bank or capacitor circuit breakers is provided in the substation design.

The difficulty of isolating a 26-kv bus section for maintenance and the short life of galvanizing in industrial atmospheres were deciding factors in the use of aluminum for the 26-kv structure. Estimates using structural aluminum at Duwamish show the maintained cost of aluminum is about 1.25 times the maintained cost of galvanized steel. This is on the assumption that operating clearances for painting can be obtained. But the 25% difference is wiped out when account is taken of the cost of working clearances and short hours for painting crews.

Fabrication followed standard structural practice, except that bolt holes were sub-punched and reamed to size on the job. Such reaming is an unnecessary refinement. It will not be followed in the future. The bus structure was designed to avoid unsightly deflections caused by the low modulus of elasticity of aluminum. Special consideration was given to securing adequate rigidity in members subjected to tortional loads imposed by disconnect operating mechanisms, however small these loads appeared to be. The structure is fabricated from standard structural shapes of alloy 6061-T6.

Duty on the 26-kv bus was limited to 1,500 Mva because of the greatly increased cost of 2,500-Mva breakers.



ALUMINUM STRUCTURE for 26-kv bus eliminates need for outages required for maintenance of galvanized structures

CONTROL TUNNELS under 26-kv bus sections house cubicles for instrumentation, control, circuit breaker relaying

When additional transformer banks are installed, bus-tie reactors will be required to limit the duty to this value. Provision has been made for their installation.

The 26-kv bus is rated 4,000 amp. Aluminum conductor was selected because of a 20% cost saving over copper. Bus is formed of two 5-in., 6063-T6 aluminum channels, face to face as shown in Fig. 1. Channels are connected mechanically and electrically by spacer bars and bus tabs, welded to the channels. The channel shape was selected for mechanical strength to resist short-circuit forces. High strength bus-support insulators were required because of the high short-circuit duty. An example of how the bus is mounted on insulators is shown in Fig. 2. Bus clamps are 6061-T4 aluminum.

A completed section of channel bus was tested for temperature rise at bus tabs and butt welds in the channel. Tests showed a maximum rise of 28 C. The design value is 30 C.

To minimize corrosion problems, bolted connections were avoided wherever it was feasible to use welded connections. Each 26-kv bus is 253 ft long, with no expansion joints, and consists of 40-ft lengths of channel butt-welded together. Each bus is fastened at the mid-point and is free to expand in both directions.

Connections from the bus to disconnect switches are 1,000-MCM aluminum cable fitted with welded terminals. These are bolted to bus tabs and disconnect switch pads. Surfaces of all bolted connections were abraded under a protective film to destroy oxide.

Connection Practice

Aluminum-to-aluminum connections are made with aluminum bolts. Aluminum-to-copper connections are galvanized steel bolts. Bellville washers maintain a relatively-constant joint pressure throughout the temperature range. Copper conductors were used between vertically mounted disconnects and oil circuit breakers to avoid use of aluminum where it would be subject to drainage from copper fittings or equipment.

Field fabrication of bus sections proved to be much more difficult than anticipated. But, satisfactory welding techniques were established using inert-gas-shielded, electric-arc equipment with consumable electrodes. Carbon-block backing strips formed to the inside contour of the channel, obtained 100% weld penetration.

The 26-kv oil circuit breakers are on the roof of a tunnel running the full length of each 26-kv bus section and terminating at the control house. Concrete walls between circuit breaker bays isolate and support overhead bus structures. In the tunnel immediately below each breaker is a free-standing cubical which houses all instrumentation, relaying and control. This feature minimized control cabling and expedited installation.

Control wiring was drawn through a single conduit sleeve in the tunnel's roof. Sleeves are connected to breaker housings by Neoprene-covered flexible conduits. Control-power buses were run on insulated supports mounted on the tunnel wall. More than ample room for common wiring was available in a single control-cable tray mounted near the tunnel ceiling. Breakers may be controlled locally at each cubicle or may be operated from a board in the control room. Miniature switches were used for this purpose. No instrumentation is provided at the control board.

The ring bus in the 230-kv switchyard is of all-welded aluminum tubing supported on pedestals on five NEMA-standard bus insulators. All bus was detailed for shop fabrication. Terminals were formed by flattening the ends as in Fig. 3. Economy of this terminal depends upon available shop facilities. Forming them requires the use of a press, dies, and controlled heating to avoid splitting the tubing. An alternate cast aluminum terminal, Fig. 3, has been adopted. Under most circumstances it will be economical.

Four 230-kv oil circuit breakers rated 10,000 Mva, 3 cycle are installed with isolating disconnecting switches. Additional ones are in transformer and line positions to permit closing the ring bus should a line or transformer bank have to be removed from service for an extended period. Line disconnects have grounding blades.

The 230/26-kv transformers are rated 75/100/125 Mva. The high-voltage winding has an 825-kvBIL. The 230 and 26-kv windings are star connected, and the 13.8-kv delta winding is not brought out. With the ASA allowance for load-factor and reduced ambient temperature on system peak, each transformer will be capable of handling about 165 Mva. Under full development with four transformer banks installed, the station will have a firm rating of 495 Mva.

Oil coolers are mounted separately from the main transformer tank for ease of maintenance and to reduce fire hazard. The transformers will be equipped with an automatic water-spray fire protection system controlled by fire-sensing devices and the bank differential relays.

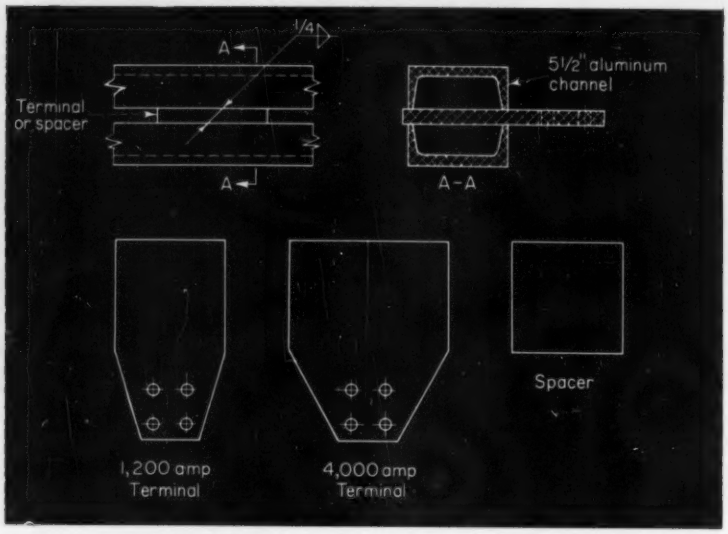


FIG 1—TWO 5½-IN. CHANNELS form 26-kv bus and carry rating of 4,000 amp. Tests of bus sections show temperature rise of 28C at tabs, welds

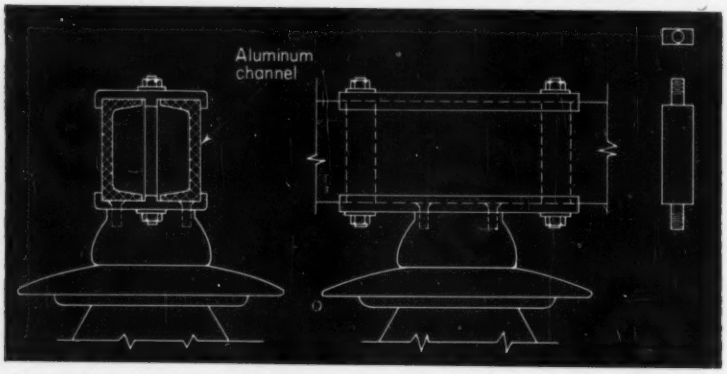


FIG 2—HIGH STRENGTH INSULATORS support the 26-kv bus because of high short-circuit duty. Each bus, fastened at midpoint, is free to expand both ways

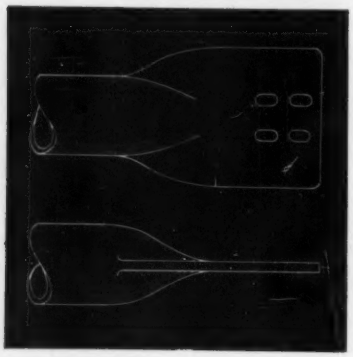


FIG 3—TERMINALS for 230-kv bus were formed by flattening ends of tubing

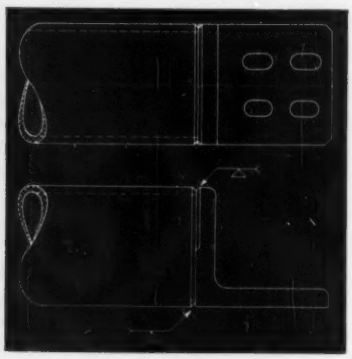


FIG 4—CAST ALUMINUM terminal will be used as it's often more economical

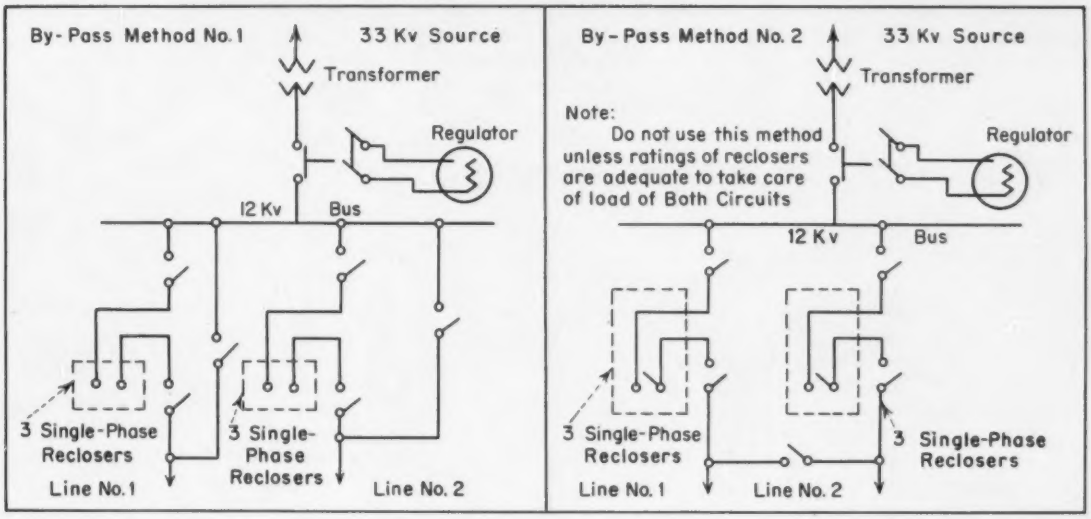
Direct Burial Cable Cuts Cost

Use of direct-burial cable in the 230-kv switchyard for control and relaying circuits resulted in a 50% saving over conventional practice. This cable is polyethylene-insulated, each insulated conductor jacketed with extruded nylon. Cables have an overall sheath of polyvinyl chloride. Cables are bedded in sand and covered by 2-in. creosoted planks.

A 30x50-ft building houses all centralized control. A conventional control board for the 230-kv switchyard is on the main floor with relay cubicles in the basement. The basement contains the battery room, heating and ventilating equipment, and station service switchgear. Adequate air circulation throughout the building and tunnels prevents condensation or excessive humidity.

Four 14,400-kvar, 26-kv banks of capacitors supply part of the system reactive requirements. Capacitor banks are arranged to permit increasing the capacity of each to 28,800 kvar. Capacitors are connected in double-wye with floating neutral. They are switched in 14,400-kvar blocks by oil circuit breakers with low-ohmic-valve resistors. Capacitor breakers will be supervisory controlled.

Duwamish substation now has been in operation one year, and has been manned 12 hr per day. But supervisory control will limit attendance to visits by a roving operator, and full time only during severe storms. The attendant's duties were largely confined to observing. He also did switching for line clearances when a large amount of line work was being done in the vicinity.



Reclosers on Feeders Pay Off

Modern single-phase oil circuit reclosers have economic, operating advantages that extend applicability beyond use for sectionalizing

J. L. WHITE, Division Supervising Engineer, Appalachian Electric Power Co, Roanoke, Va.

Today's improved single-phase oil circuit reclosers have economic and operating advantages that extend applicability beyond customary use as line sectionalizing devices.

Heavy-duty reclosers, now available with an interrupting rating of 4,000 amp (5,600 amp asymetrical at rated kv), can serve station transformers rated as high as 7,500 kva at 12 kv and larger in some instances. They can be applied on 12-kv feeders from substation buses at a lower cost than oil circuit breakers, particularly for rural and residential loads.

Three heavy-duty single-phase reclosers with conventional bypass or feeder-to-feeder tie switches can be installed for about $2,000. This contrasts with about $5,000 for a 15-kv 100-Mva oil circuit breaker with its necessary foundations, bypass disconnects, battery, control wiring, and cabinet. As the steel and bus work for the breaker or recloser cost about the same, the saving with reclosers is about $3,000 per circuit.

Single-phase oil circuit reclosers also have operating advantages over oil circuit breakers on wye-connected systems. Reclosers have been improved until they are among the most dependable devices on distribution systems. They cause fewer customer outages. Most line faults being line-to-ground affect only one phase wire. Hence only a third of the customers served from a station with single-phase reclosers would be interrupted. The fault can be located and service restored more quickly as only one phase needs to be patrolled.

Series-trip reclosers often perform as well as relay-controlled feeder breakers when a circuit must be sectionalized. The advantage of faster tripping of ground faults is lost because the ground relays frequently must be set as high as line relays. (Appalachian Electric Power uses only one ground relay in series with two line relays on feeder breakers.) As a recloser requiring inspection and repair can be replaced by a spare in 30 min, bypass fuses are unnecessary. The removed recloser can be returned to the shop for servicing.

While single-phase station reclosers may cause a few more single-phase operations of 3-phase motors, such operations also result from blowing of transformer or customer's fuses, or breaking of one line conductor. Power customers should provide proper fusing to protect against excessive single-phase operation on all 3-phase motors.

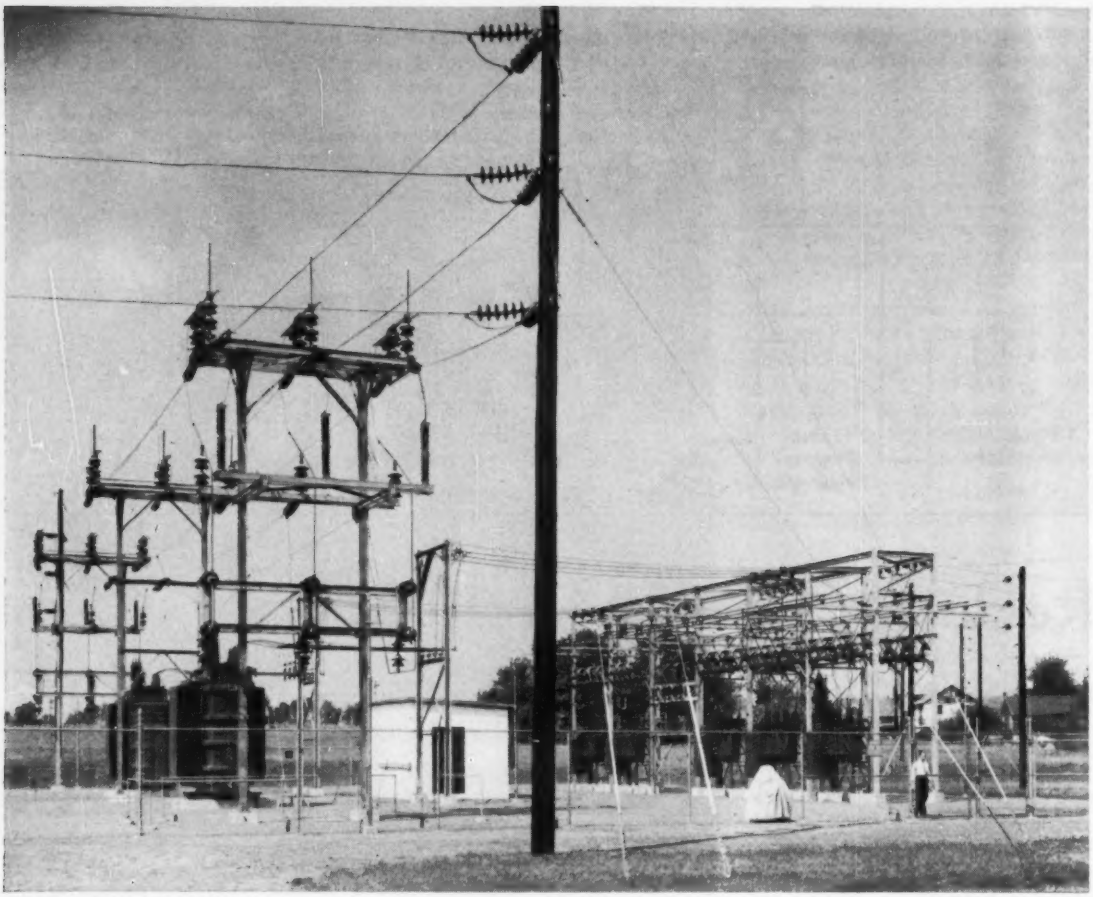
Application of single-phase reclosers should be limited to 12-kv feeders supplying predominantly residential and commercial loads and circuits having no 3-phase banks exceeding 600 kva. Larger transformer banks may cause trouble from feedbacks. Each job should be engineered to assure that the reclosers have adequate interrupting capacity for expected increase in station transformer capacity. Reclosers on a feeder-to-feeder tie should have sufficient carrying for the loads on both circuits.

Present reclosers are generally limited to 5,000 kva or smaller distribution substations for two reasons:

1. Their interrupting rating depends somewhat on the rating of the series trip coil.

2. 280-amp reclosers are rated for the current equivalent of 5,600 kva at 12 kv.

Except in smaller substations such a recloser would not have enough capacity when two feeders are tied together, but several manufacturers are developing 400-amp reclosers in 100 and 250-Mv ratings. The latter will overcome these limitations.



Steel Ground Networks Cost More

Experience of Pennsylvania utility shows that:

- **Cost of protected steel substation grounding network was 150% more than equivalent copper one**
- **Necessary cathodic protection costs almost as much as the steel network itself**
- **Added cost may be justified in stations that have important buried facilities subject to corrosion by a copper ground system**

S. J. LITRIDES, Senior Project Engineer, Pennsylvania Power & Light Co, Allentown, Pa.

All-steel grounding systems for switching stations and substations, developed during the postwar copper shortage, have proved electrically equal to copper. However, they do require more cathodic protection than had been anticipated. When this is provided, they become more complicated and costly than copper for substations.

Pennsylvania Power & Light Co now has a tested design (EW, May 2, 1955, p 59) for steel grounding systems for use when copper is not available and in stations having important facilities underground that would be subjected to corrosion by a copper ground system.

Steel grounding systems have the same layout, physically, as copper grounding systems, but steel conductors have five to six times the cross-sectional area. Random lengths of black steel bars 3 x ⅜ in. and 3 x $\frac{7}{16}$ in. by 10 to 20 ft, with welded joints and taps, are used where 4/0 and 2/0 copper grounding conductors would normally be used. Fig 1 shows a grounding system that can use either copper or steel conductors for a typical substation large enough to accommodate two to four 66-12-kv, 10,000-kva transformers and several 12-kv feeders.

Pennsylvania P&L substation designs have practically eliminated metallic underground piping, conduits, cable sheaths, etc. This reduces to a minimum the buried facilities subject to galvanic corrosion. Principal exception is steel anchors for guys.

But a steel grounding system buried in the earth is itself subject to natural or self corrosion which limits

its useful life unless special means are taken to prevent such action. The most effective means of mitigating this type of corrosion is by cathodic protection consisting of a suitable source of direct current and buried anode beds to provide for the discharge of protective currents into the earth.

Magnesium anodes which inherently have 0.7 to 1.0-v galvanic potential to steel were used in a few instances for obtaining cathodic protection because they eliminate need for an external dc source. These anodes were buried relatively close to the steel network and electrically connected to it with insulated copper conductors.

But magnesium anodes are unsatisfactory where soil resistivity reaches 10,000 to 80,000 ohm-cm. Output from each 17-lb anode varied from 5 to 25 milliamp; whereas at least 50 milliamp is usually desired. This type of cathodic protection has been abandoned in favor of the dc rectifier-anode bed scheme.

Higher cathodic voltages of a rectifier-anode-bed combination can overcome the effect of high soil resistivities to obtain the required protective currents. A standard rectifier rated 5 amp dc at 0-150 v is adequate for most stations with an area of about 100 x 200 ft. A typical installation is shown.

The number and location of anode beds depends primarily on obtaining effective distribution of cathodic current through the earth to insure that all parts of the steel network are protected. Anode beds were placed as close to the steel network as possible to obtain low over-all circuit resistance but far enough away to provide an optimum distribution of current. Anode beds 50 to 200 ft long, made from scrap steel, were buried several hundred feet from the station area. One bed was found sufficient for stations less than 100 x 100 ft in area. Larger stations usually required two to four beds to provide the required protection. Anode beds are designed for 40-yr life based on deterioration at 20 lb per amp yr.

Typical Installations of All-Steel Station Grounding Networks

Substation	Approx. Area Sq ft	Station Ground, Ohms	Cathodic Protection
Bear Gap 66–12 kv	5,900	3.0	9 Mg anodes—0.20 amp total
Nazareth 66 kv	37,800	1.75	Rectifier, Anode—2.5 amp at 46 v
Paxton 66–12 kv	9,700	0.8	Rectifier, Anode—1 amp at 15 v
Rockville 66–12 kv	5,000	3.0	Rectifier, Anode—1.7 amp at 10 v

Tests after installation determine the amount of cathodic protection a steel network requires. Numerous potential readings are made over the network area, using a test anode bed at several locations outside the steel network, a copper-to-copper-sulphate half-cell reference probe, a 200,000 ohm-per-volt dc voltmeter, and a source of variable dc potential. Fig 2 diagrams the test setup. Readings are taken of normal potential with cathodic current off and of elevated potential with cathodic current on. Dividing the difference of these readings by the current gives voltage rise per cathodic amp.

Steel is usually about 0.40 to 0.70 v negative to earth, measured with a copper-cell reference probe, and is raised to 0.85 v negative by application of cathodic current. This value of −0.85 v has been found by others to provide a relatively high degree of protection against self-corrosion for buried bare steel.

The maximum amount of cathodic current required is determined from the lowest readings in "shielded" areas within the network. The required values are checked by

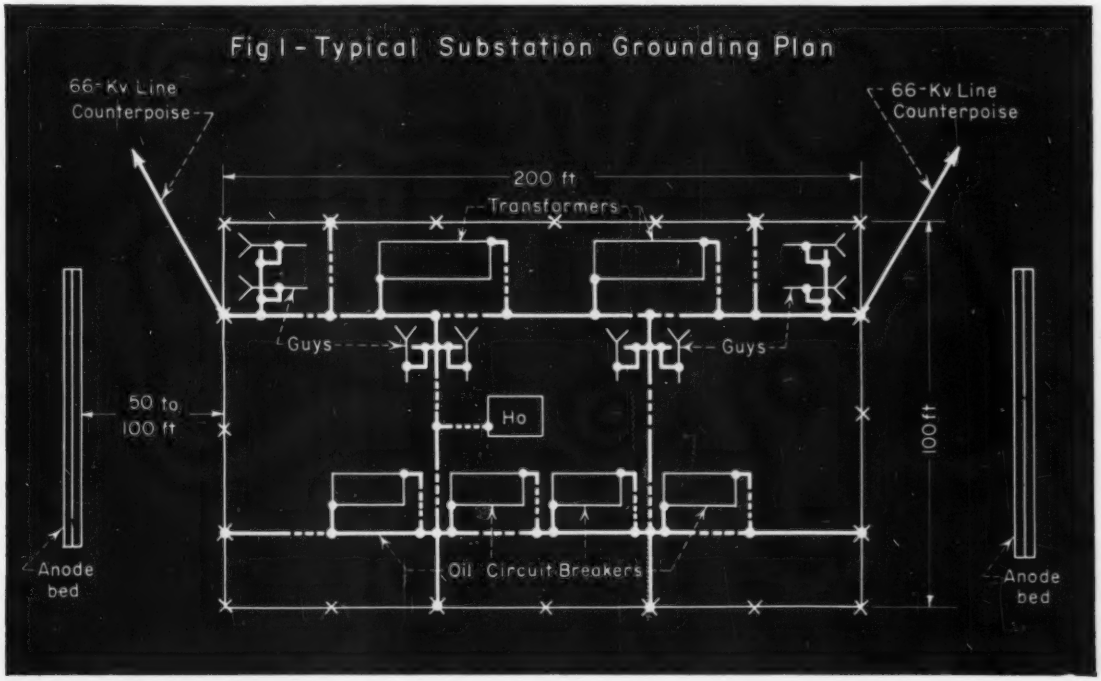
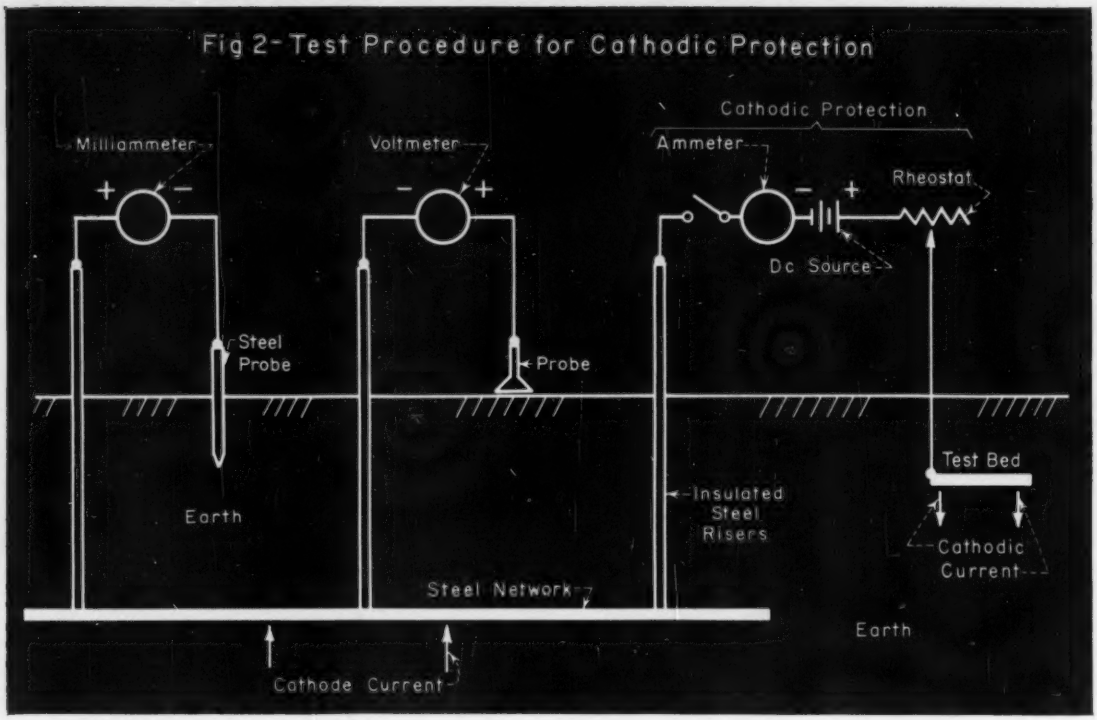


Fig 1 - Typical Substation Grounding Plan



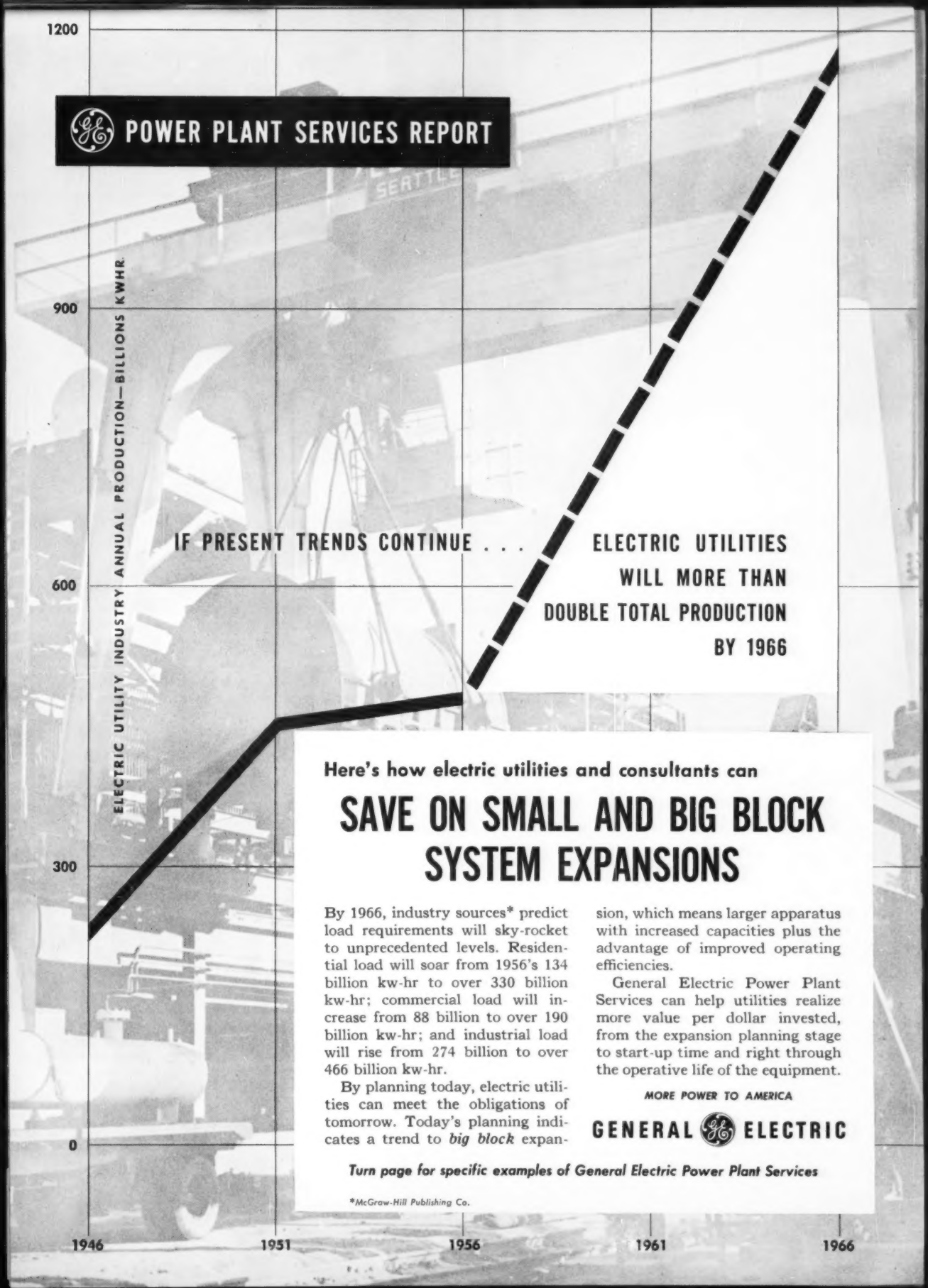
SUBSTATION CATHODIC RECTIFIER—Mounted on wall of the substation utility house is a 5 ampere, 0-150 volt d-c rectifier in a ventilated wooden housing. Variac control for variable output voltage permits the adoption of a standard rectifier unit for use at any location. The negative connection from the rectifier to a steel ground riser can be seen at the bottom

a steel probe inserted in the "shielded" areas and connected to the steel network through a low resistance milliammeter or microammeter. Current flow from the network through the meter should be reduced or reversed with the application of cathodic current. Medium-size stations have been protected with 1 to 5 amp at 10 to 75 v. The accompanying table lists substations with steel grounding systems where tests have been made and cathodic protection installed.

Design and layout of cathodic protection may be difficult in certain cases where the steel network is near other extensive buried structures. Anode beds must be placed carefully to prevent current flowing on these foreign structures and resulting in cathodic damage. If such structures are bonded to the steel network, cathodic current in the earth divides between the foreign structure and the steel network decreasing the effectiveness of the cathodic protection. Excessive currents may be required for complete protection unless these structures are electrically isolated.

A steel network system for a station area of 100 x 200 ft costs about 35% more than an equivalent copper system. This is primarily due to the higher cost of welding compared to standard copper connections and to the installation of special steel taps or risers from the grounding network to equipment. These steel risers are galvanized steel bars about 6 ft long, welded to the network and painted with several coats of Neoprene paint to prevent ground-line corrosion.

Cathodic protection for a steel network costs nearly as much as the network itself. The total cost for a protected steel system is about 150% higher than the equivalent copper system, neglecting expenditures for periodic inspection and maintenance.



POWER PLANT SERVICES REPORT

IF PRESENT TRENDS CONTINUE . . . ELECTRIC UTILITIES WILL MORE THAN DOUBLE TOTAL PRODUCTION BY 1966

Here's how electric utilities and consultants can

SAVE ON SMALL AND BIG BLOCK SYSTEM EXPANSIONS

By 1966, industry sources* predict load requirements will sky-rocket to unprecedented levels. Residential load will soar from 1956's 134 billion kw-hr to over 330 billion kw-hr; commercial load will increase from 88 billion to over 190 billion kw-hr; and industrial load will rise from 274 billion to over 466 billion kw-hr.

By planning today, electric utilities can meet the obligations of tomorrow. Today's planning indicates a trend to *big block* expansion, which means larger apparatus with increased capacities plus the advantage of improved operating efficiencies.

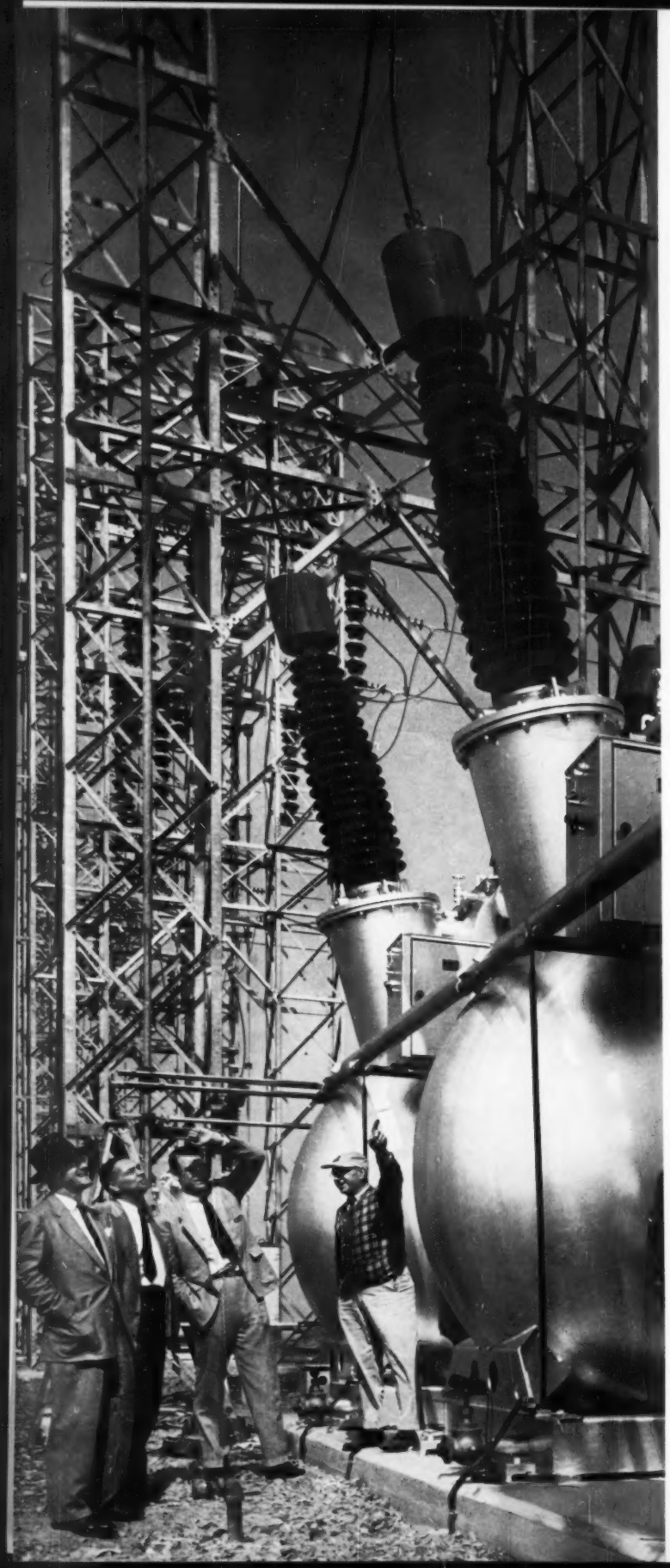
General Electric Power Plant Services can help utilities realize more value per dollar invested, from the expansion planning stage to start-up time and right through the operative life of the equipment.

MORE POWER TO AMERICA

GENERAL ELECTRIC

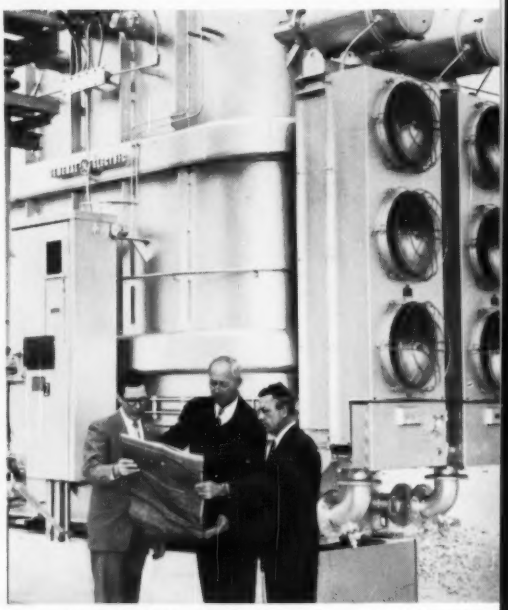
Turn page for specific examples of General Electric Power Plant Services

*McGraw-Hill Publishing Co.

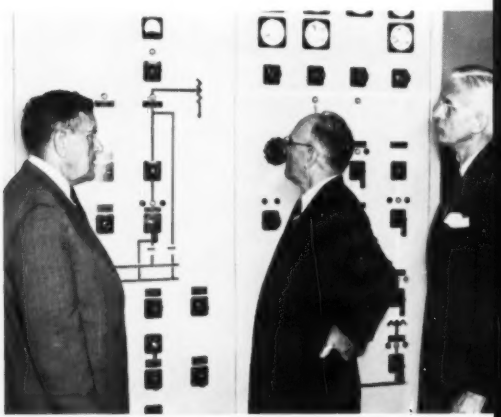


Many electric utilities

Save valuable



FLORIDA POWER & LIGHT expanded by 231,000 kw, nameplate rating, with G-E equipment at Cutler station. L. H. Hill, Jr., G.E.; E. J. Pearch, Station Supt.; J. W. Lacy, Jr., G.E; note G.E.'s co-ordination of details on 42,500-kva FOA power transformer conserved engineering time.

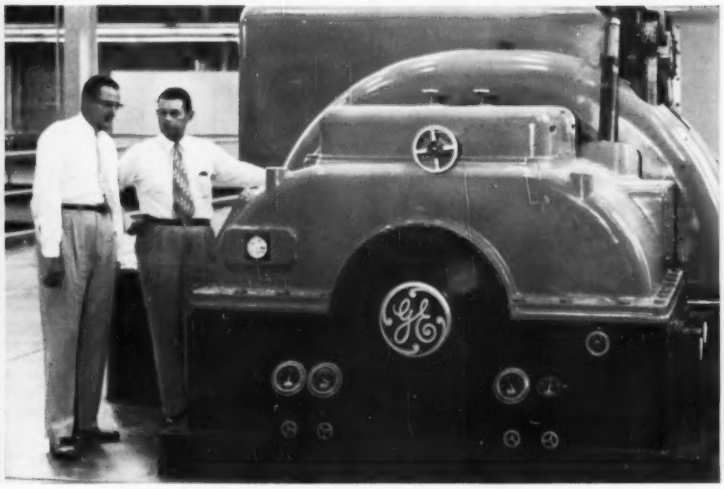


OKLAHOMA GAS & ELECTRIC stepped up capacity 20% with all-G.E. Arbuckle station. G.E.'s scheduling speeded construction, meant on-time start-up, as noted by L. Skog, Pres., Sargent & Lundy; W. B. Gesell, V. Pres., OG&E; C. H. Linder, G-E Vice Pres., at G-E master control panel.

PACIFIC GAS & ELECTRIC'S Pittsburg station produces 660,000-kw; G-E equipment includes 230-kv breakers. Left, J. Anderson, G.E.; K. Bausch, R. Stater, Bechtel (engrs. & constructors); G.E.'s J. D. Webster note how G-E Power Plant Services meant integrated equipment designs.

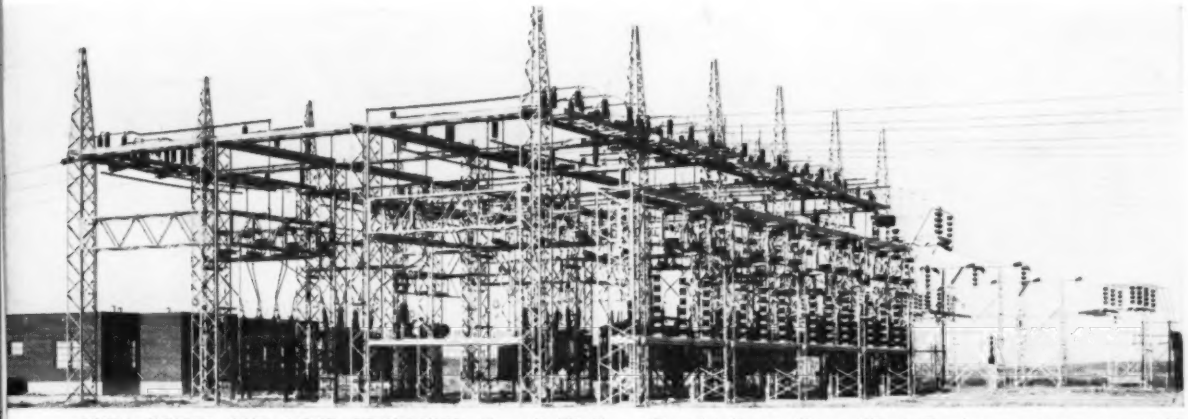
like these . . .

time, money and manhours with General Electric Power Plant Services



SOUTH CAROLINA ELECTRIC & GAS raised total capacity 20% with its 100,000 kw G-E turbine generator at the Urquhart Station. Above, General Electric's M.O. Troy, Jr. and F.R. McMeekin, Vice President of SCE&G, note that purchase of this third G-E unit plus other major electrical equipment simplified ordering of equipment, hastened start-up time.

MISSISSIPPI POWER & LIGHT'S all-G.E. 210,000-kw Delta steam plant was started up on schedule, G-E engineers trained operators to assure MP&L full operating knowledge of equipment, noted here by G.E.'s T. R. Brock, MP&L's D. C. Lutken.



IOWA POWER AND LIGHT COMPANY'S Council Bluffs steam station bolstered capacity by 44,000 kw. Installation help, including h-v switchyard shown here, speeded start-up.

For details on Power Plant Services, contact your G-E Apparatus Sales Representative or write Section 302-12, General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC

For more data on how G-E power plant services work for you, see next page ►

POWER PLANT SERVICES REPORT

These are the cost-saving power plant services on your job when you specify General Electric

APPLICATION ENGINEERING co-ordinates all items of electrical equipment in design, operation. Here, at model of Hartford Electric Light's 66,000-kw G-E equipped Middletown station, are G.E.'s F. C. Roberts, HELCO's J. C. Sonntag and K. L. Partridge; G.E.'s A. P. Wylie; and HELCO's S. Kusmik, D. C. Switzer and H. T. Barrows.

PRODUCT DEVELOPMENT gives you equipment incorporating latest design features. Above, Kansas City Power & Light Vice President J. A. Keeth, G.E.'s C. M. Sagmoen and H. S. Day discuss General Electric automatic dispatching equipment in operation on Kansas City Power & Light's system.

FIELD SERVICE ENGINEERING assures supervised installation, planned start-up. Above, Central Hudson Gas & Electric's Danskammer Point station unit No. 2 is discussed by G.E.'s C. B. Wilson; Ralph Roe, Pres., Burns & Roe; W. West, G.E.; R. B. MacGuinness, Vice Pres., CHG&E.

POWER PLANT CO-ORDINATION helped assure on-time manufacture, delivery of equipment at plant site of Indianapolis Power & Light's White River station. IP&L's Vice Pres. D. C. Hess, J. D. Blythe, President H. T. Pritchard, review delivery schedules with John Calder, G-E Sales Engineer.

SERVICE ENGINEERING helps keep plant operating at full capability. At Central Power & Light's G-E equipped 132,000-kw Lon C. Hill plant, G.E.'s R. M. Eichner reviews with Mark Lovelady, CP&L Vice Pres. and Chief Engineer, a planned equipment maintenance schedule.

MORE POWER TO AMERICA

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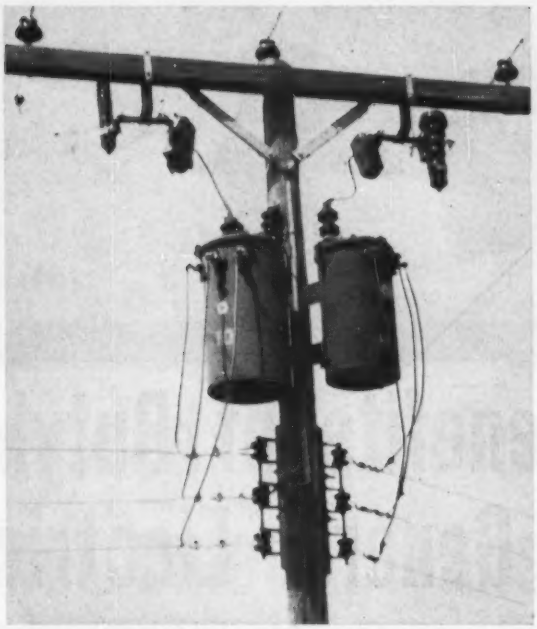
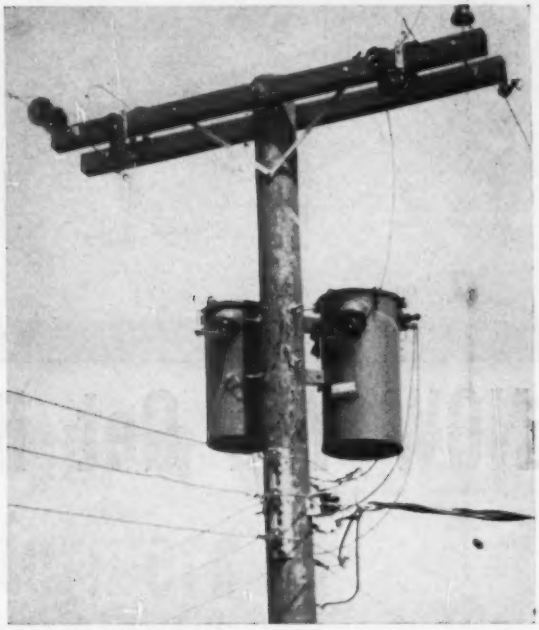
LIVE BETTER ELECTRICALLY



FRONT VIEW of open-delta transformer mounting shows two units slightly angled from each other, and single arm



CLIMBING SIDE VIEW shows cutouts and arresters on line arm and connected directly with the transformer terminals

DISTRIBUTION—Construction

Saves on Open-Delta, Welding Transformers

R. F. BOGAN, District Foreman, Ohio Power Co, Lima, Ohio

Two transformers connected open-delta can serve a customer whose connected load is largely lighting with a small amount of 3-phase equipment. Illustrated is a safer and more economical mounting for such transformers than is customarily used. It is particularly applicable where two transformers in open-delta can serve predominantly lighting load with a little 3-phase, or where a separate transformer must be installed to serve a welder.

Crossarm Cost Saved

The older practice of installing two units like a three-transformer bank with one unit eliminated required double and single 8-ft crossarms. The newer method saves the cost of transformer crossarms and related material. Transformer brackets are attached to adjacent quarter sections of the pole with through bolts, the other half of the pole being left clear for climbing and working space. The two cutouts and arresters are on the line arm, connected directly with the transformer terminals. Although some 4-kv installations may require 5-ft taller poles to provide space for secondaries below the transformers, most Ohio Power Co's existing facilities provide sufficient space.

Wye-delta or delta-delta installations require transformers with two primary bushings, but single-bushing units can be used on wye-wye installations.

When an open-delta transformer setting is applied for a customer with a small 3-phase load, removal of one transformer would not involve rebuilding the lighting installation if the customer moved or discontinued using his 3-phase equipment.

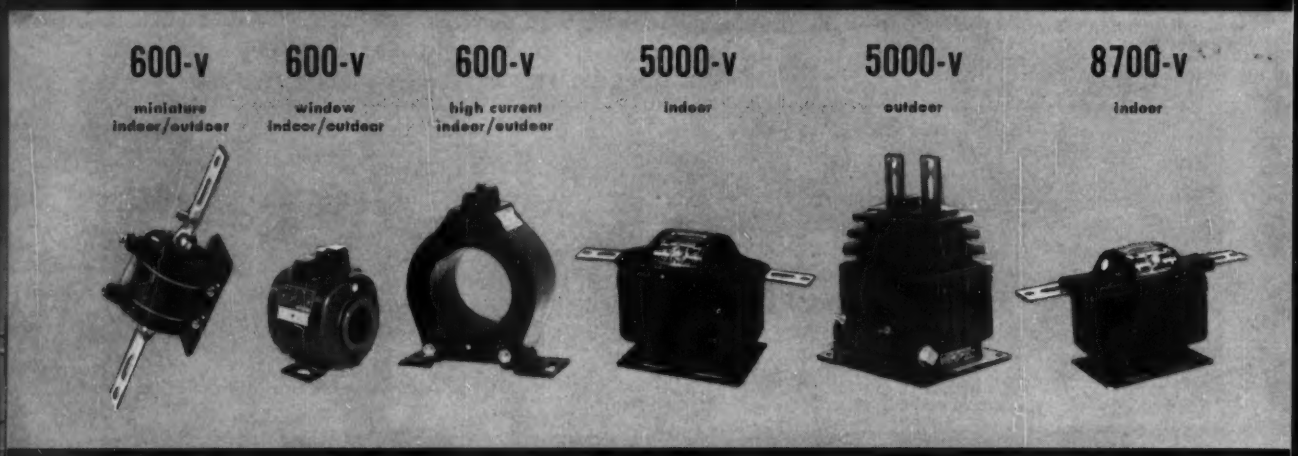
Similar transformer mountings are practicable wherever a single transformer is installed for single-phase, 3-wire service and another is needed for welding service only. In one such instance, the installed transformer remained in its position. The extra unit was placed on the adjacent quarter section of the pole, and an additional cutout and arrester were mounted. When welder service is discontinued, its transformer can be removed without disturbing the other transformer.

Saves Over $32 Per Setting

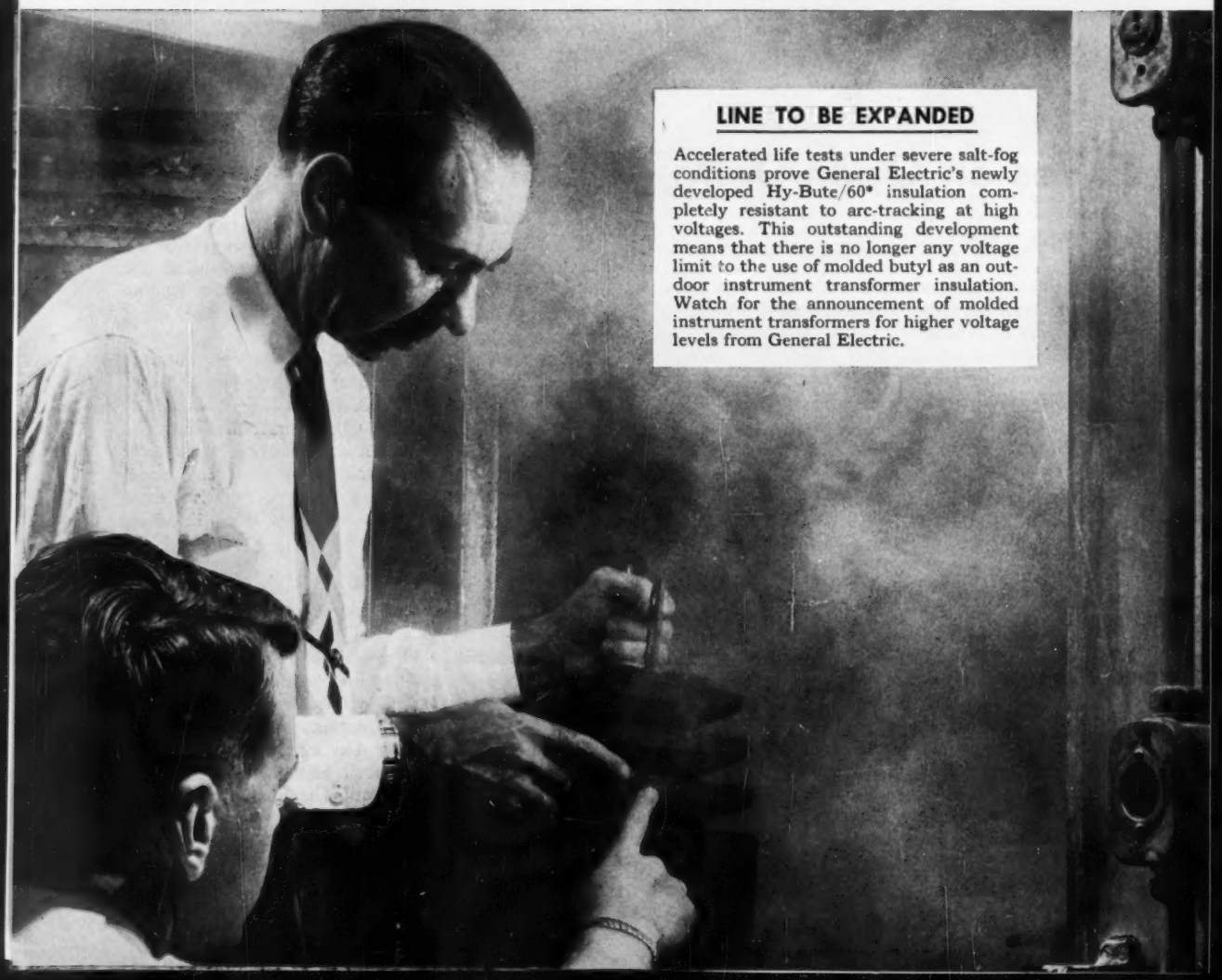
In such installations, 50-kva or smaller transformers can be used.

The new method saves more than $32 per setting over the old method of mounting two transformers. The cost of the old method would be increased by periodic replacement of the transformer crossarms. If the new method requires 5-ft taller poles for 4-kv installations to provide space for the secondary circuit below the transformers, the installed-cost advantage would approximate $11.

(*More How To on page* 104)



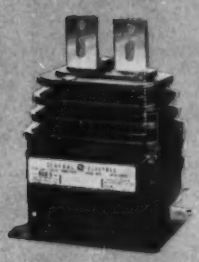
NOW You Get Benefits of Butyl-General Electric



LINE TO BE EXPANDED

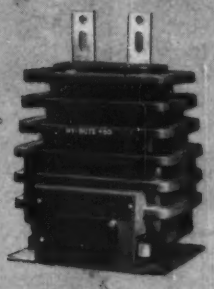
Accelerated life tests under severe salt-fog conditions prove General Electric's newly developed Hy-Bute/60* insulation completely resistant to arc-tracking at high voltages. This outstanding development means that there is no longer any voltage limit to the use of molded butyl as an outdoor instrument transformer insulation. Watch for the announcement of molded instrument transformers for higher voltage levels from General Electric.

8700-v
outdoor



15000-v
indoor

15000-v
outdoor



COMPARISON CHART

G-E	X	X	X	X	X	X	X	X	X
MFR-A	X			X					
MFR-B		X	X						

Now General Electric offers molded instrument transformers in a complete line from 600 volts through 15,000 volts.

Molded Construction in all these Instrument Transformers

New 8700-volt indoor and new 8700-volt outdoor current transformers make line complete from 600-v through 15-kv

Molded in Butyl or new Hy-Bute/60* insulation, these nine General Electric instrument transformers give you many cost-saving benefits.

Maintenance is sharply reduced because butyl is corrosion resistant. There are no metal tanks to rust out—no painting is ever required no matter how corrosive the atmosphere. Porcelain bushings, which can break during installation or operation, have been completely eliminated and continuous thermal ratings of 150% to 200% on many models minimize the need for replacing transformers with higher ratings as loads increase.

Stock needs are reduced because many of the new butyl designs replace several older types. The 600-volt butyl types provide greater application flexibility because they can be used either indoors or outdoors. You save money too, since each new butyl-molded design is priced the same as the least expensive of the older models it replaces.

Easier installation results from the smaller size and lighter weight of butyl-molded transformers. In addition, they can be mounted in any position.

Safer and more reliable operation is assured because flame-resistant butyl will not support fire. Design features such as increased creepage distance add to the dependability of this complete family of molded instrument transformers.

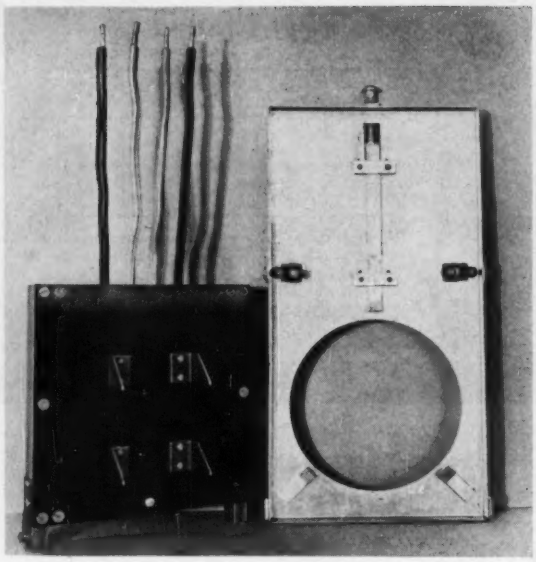
Only General Electric brings you all the advantages of butyl-molded construction in a complete line of indoor and outdoor current transformers from 600-v through 15-kv. For details, call your General Electric Apparatus Sales Representative or request bulletin number GED-3112 from Section 581-3, General Electric Company, Schenectady 5, New York.

LIVE BETTER ELECTRICALLY

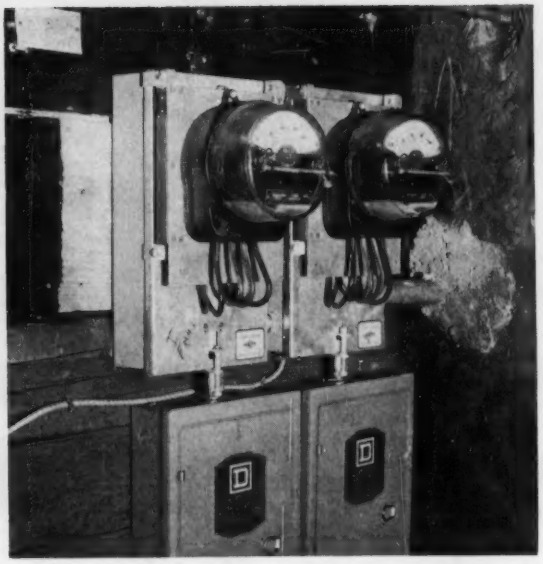
** Trade-mark of General Electric Co.*

Progress Is Our Most Important Product

GENERAL ELECTRIC



METER CHANGE ADAPTER facilitates mounting bottom-connected meters to new meter socket mountings in changeovers



ADAPTERS are particularly helpful in meeting demand for residential re-wiring due to adequate wiring promotions

Adapter Facilitates Meter Changing

FREDERICK J. LAMBERT, JR, Meter Supervisor, Passaic Division, Public Service Electric & Gas Co, Newark, N. J.

A meter change adapter facilitates mounting bottom-connected meters to new meter socket mountings in Public Service Electric & Gas Co of New Jersey territory, where changes from two to three-wire services have increased lately. The adapter should prove particularly helpful in meeting demand for residential re-wiring resulting from adequate wiring programs.

The adapters, fitting both standard 100-amp round sockets and 100-amp indoor meter enclosures, may be wired for a two-wire or three-wire meter, and their built-in jumpers relieve electricians of the job of installing jumpers. Adapters are marked for changing an existing two-wire to a three-wire meter, or for changing one three-wire meter for another. In all changes, the neutral of a new service is tied to that of the service drop.

For changing a service from two to three wire, both live legs of the new service are tied to the existing live leg of the service drop at the service entrance point. When a three-wire meter is being changed for another three-wire meter, each live leg of the new service is tied to a separate existing live leg of the service drop.

Formerly, extended service interruption during a meter change could be avoided only through close cooperation of the electrical contractor with the company. The adapters, now supplied to the contractors, make the temporary connections pending inspection, thus enabling a contractor to complete a job on one trip.

Parts Are Grounded

In installing or removing adapters and cover plates, use of the proper method and sequence assures that all uninsulated parts which could become alive are effectively grounded. The installation sequence is as follows:

1. The adapter is attached securely to the meter with a mounting bolt and its leads inserted and fastened in the meter, no conductors being left exposed. The terminal cover is installed and fastened by a wrap of friction tape or a rubber ring. When the cover is missing, the meter terminals are covered with tape.

2. The cover plate is placed over the socket or enclosure, and attached to it. The plate must be vertical with the guide marks lined up with the socket jaws.

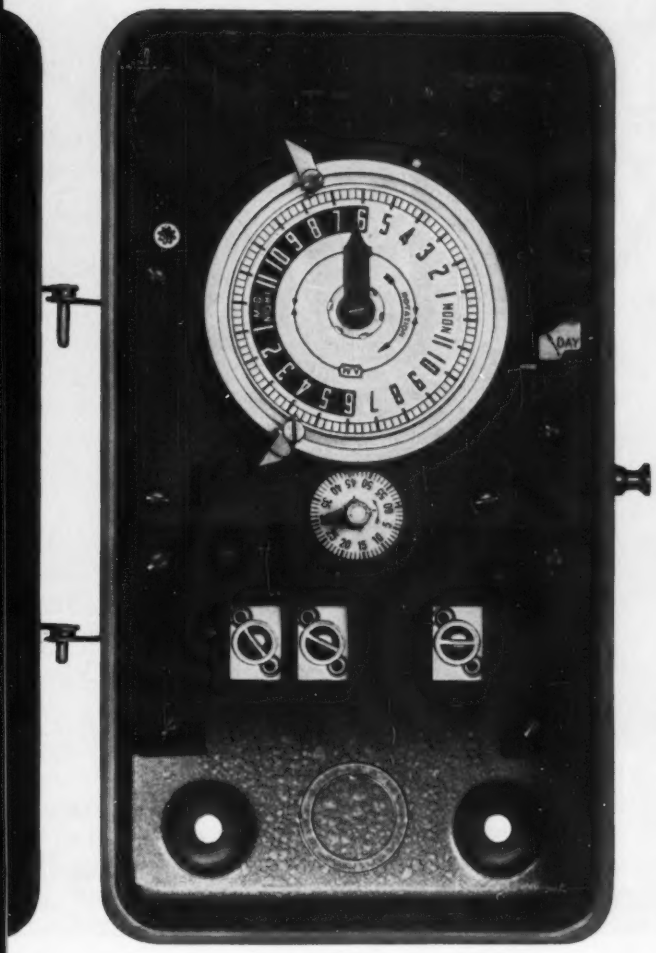
3. Mounting screws are fastened to the adapter plate firmly to assure rigid mounting and electrical bond between plate and grounded socket or enclosure.

4. With the adapter bottom swung forward, the top is hinged to the plate, springs at the hinge points grounding adapter to plate.

5. The adapter bottom is then swung down into the plate where it establishes the circuit and connects the meter.

Adapters may be removed for reuse. During removal, the adapter is pulled out at the bottom and swung up horizontally. After it has been disengaged from the plate, mounting screws on the plate are loosened, and the plate is removed.

(*More How To on page* 110)



New General Electric TSA-40 Time Switch At a New Low Price

Now you can get reliability at low cost for any ON-OFF job

The TSA-40 is a completely new heavy duty time switch engineered by General Electric to give you more reliable on-off operation at a lower price.

HIGH RELIABILITY of the G-E TSA-40 time switch is made possible by the exclusive contact shearing action, the one-piece terminals and contact blades, and the time-proven Telechron* motor. Now with weatherproof case, the TSA-40 is fully suitable for all types of ON-OFF applications, indoor and outdoor, in temperatures from −50 F to 150 F.

LOW COST means you get this reliability in the TSA-40 at prices starting as low as $22.70**. Not only this, but highly dependable operation means minimum attention, and you save money on maintenance. For off-the-shelf delivery contact your local General Electric time switch distributor or the G-E Apparatus Sales Office nearest you today. Or write for free bulletin to Section 584-5, General Electric Co., Schenectady 5, N. Y.

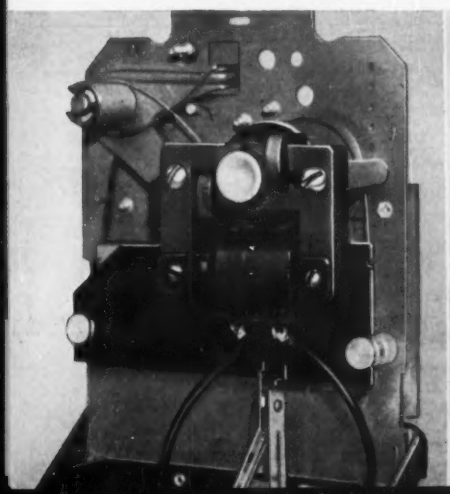
*Reg. trademark of General Electric Co.
**Manufacturer's suggested resale price for standard SPST model.

GENERAL ELECTRIC

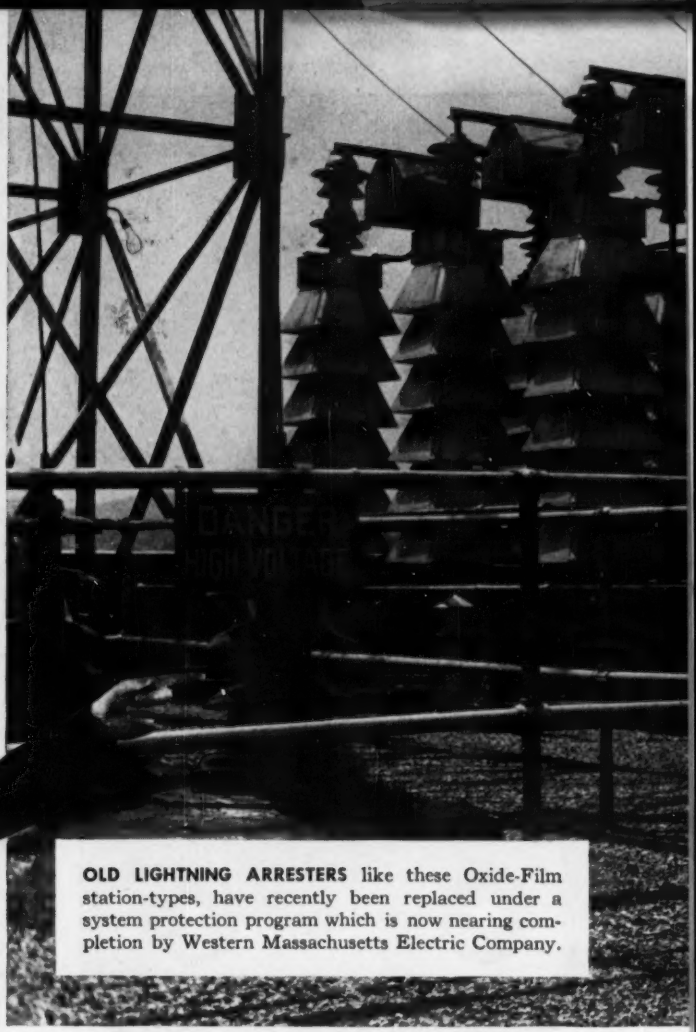
GREATER TEMPERATURE RANGE of −50 F to 150 F is made possible by improved Telechron* motor. Direct drive of switching mechanism assures positive action.

COMPLETELY WEATHERPROOF steel case has press-fit latch for tight seal and easy opening. Side-hinged removable cover simplifies installation and maintenance.

NO WIRING BURNOUTS or "hot spots" because one-piece contact and terminal assembly eliminates all internal wiring to contacts. Unit terminal block makes replacement easy.

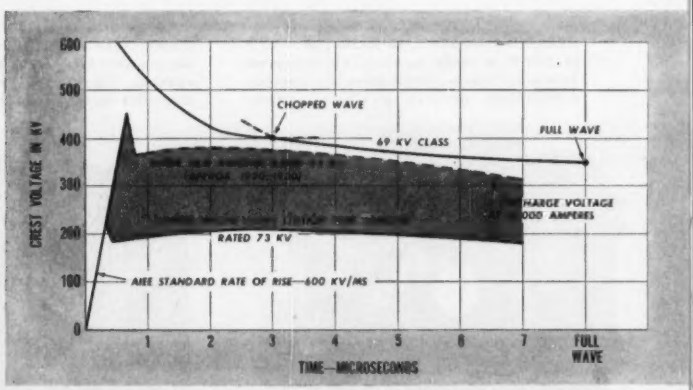


LIGHTNING ARRESTERS



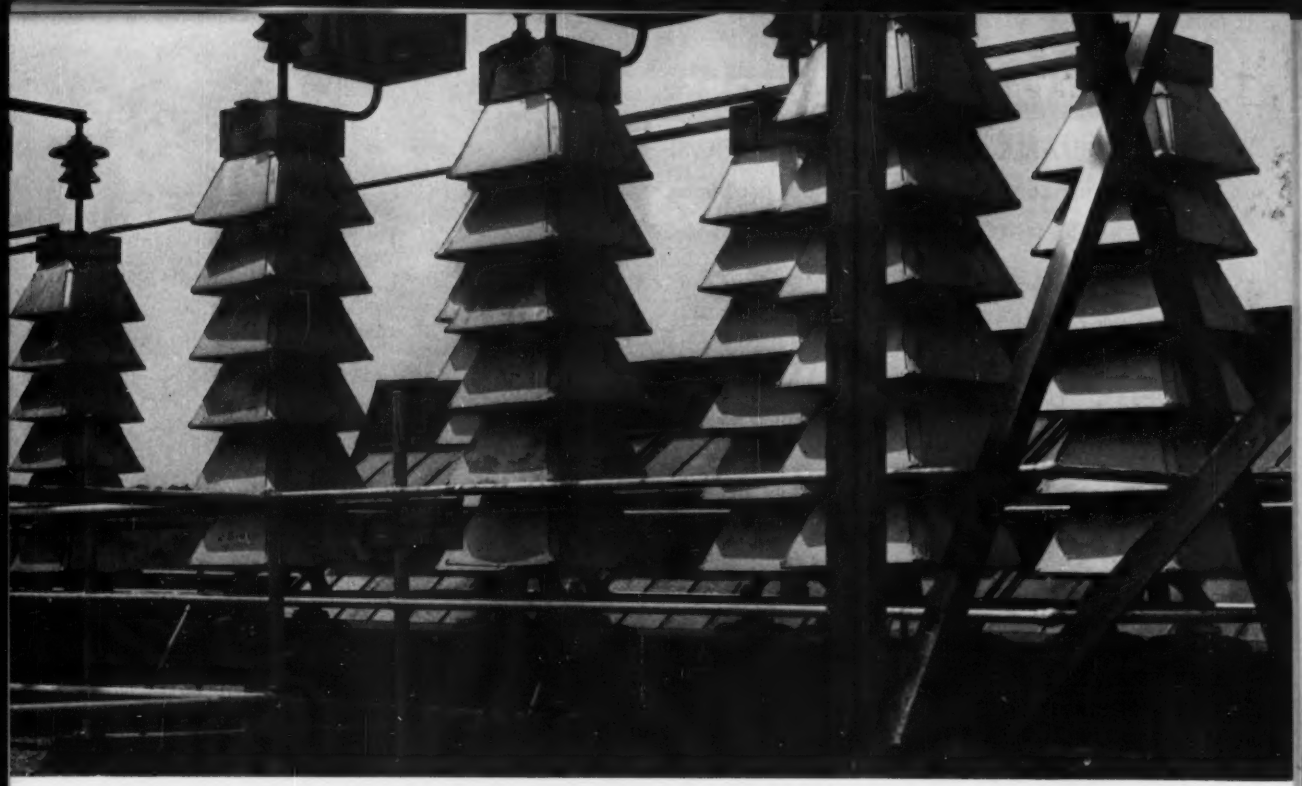
OLD LIGHTNING ARRESTERS like these Oxide-Film station-types, have recently been replaced under a system protection program which is now nearing completion by Western Massachusetts Electric Company.

W. J. RUDGE, MANAGER—Lightning Arrester and Cutout Engineering, is shown here with a new 73-Kv Magne-valve Station-type arrester. It has 52% lower impulse sparkover voltage, and 47% lower IR discharge voltage than the Oxide-Film arresters shown, representing a degree of protective efficiency heretofore unobtainable.



COMPARISON OF IMPULSE VOLT-TIME coordination curve for power transformer on 69-Kv ungrounded neutral system using oxide-film arresters and modern Thyrite* Magne-valve arresters. Colored area shows the improvement in the margin of protection obtainable with modern General Electric Thyrite Magne-valve arresters.

*Registered trade-mark of G.E. Company.



How do you decide when your old lightning arresters need replacing?

Western Massachusetts Electric, like many progressive utilities, for over 25 years has been continually re-evaluating its stations' lightning protection equipment

Determining the condition of all its *critical equipment* —then doing something about it—is just one of the ways Western Massachusetts Electric Company has been meeting the growing demand for electric power.

Considered in this category of *critical equipment* are the utility's large number of station-type lightning arresters. Surveys of all arresters during the past quarter century revealed many of such age and condition that their degree of protective efficiency was questionable. And, costs of maintenance were increasing every year.

Rather than risk its valuable equipment with these antiquated station arresters, an Adequate Protection Program was established to replace older units with modern arresters.

Thus, on an integrated planned program of equipment evaluation—which stresses *protection* levels—Western Massachusetts Electric Company regularly inspects all components of its extensive system, with special attention given to every station's lightning protective equipment.

Realistic evaluation of your station lightning arresters can help you establish an Adequate Protection Program of your own. Why not let General Electric engineers assist you in planning such a program to meet your systems requirements?

For further information on lightning arresters, contact your nearest G-E representative or write to General Electric, Section 432-19, Schenectady 5, N. Y.

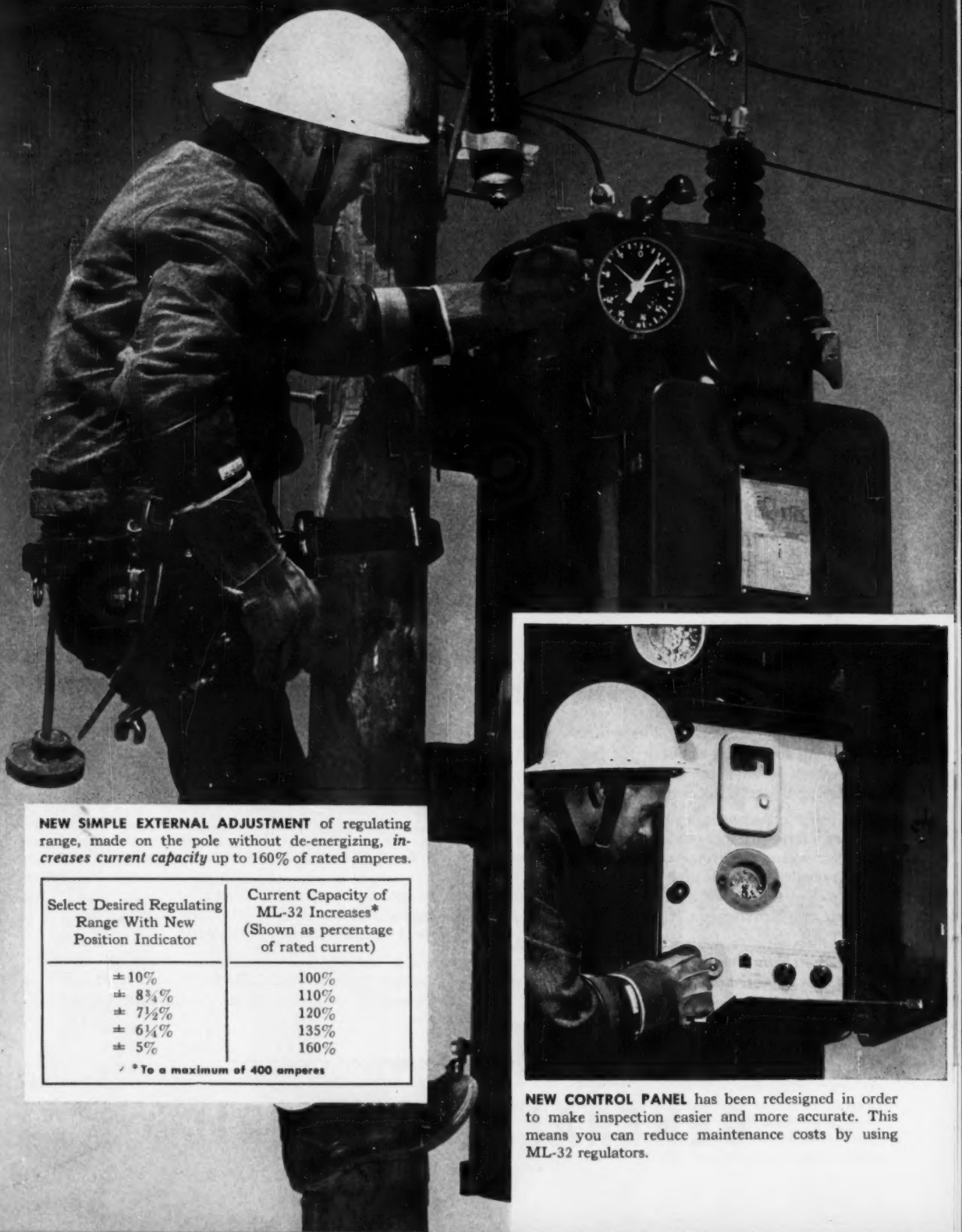
Progress Is Our Most Important Product

GENERAL ELECTRIC

VOLTAGE REGULATORS

PROFITABLE VOLTAGE REGULATION

to help solve your distribution problems



NEW SIMPLE EXTERNAL ADJUSTMENT of regulating range, made on the pole without de-energizing, *increases current capacity* up to 160% of rated amperes.

Select Desired Regulating Range With New Position Indicator	Current Capacity of ML-32 Increases* (Shown as percentage of rated current)
± 10%	100%
± 8¾%	110%
± 7½%	120%
± 6¼%	135%
± 5%	160%

* To a maximum of 400 amperes

NEW CONTROL PANEL has been redesigned in order to make inspection easier and more accurate. This means you can reduce maintenance costs by using ML-32 regulators.

With NEW G-E LOAD BONUS POSITION INDICATOR you can now

INCREASE CAPACITY WITH REGULATOR ENERGIZED

NEW LOAD BONUS switch located in the position indicator of the redesigned General Electric ML-32 step voltage regulator now permits simple, one-man, on-the-pole adjustment of current capacity and regulating range *without de-energizing* the regulator. With "raise" and "lower" settings independently adjustable, current capacity up to 160% of normal at ±5% regulation is available up to 400 ampere maximum. ***Load Bonus is now standard equipment on all G-E pole and station-type single-phase step regulators.***

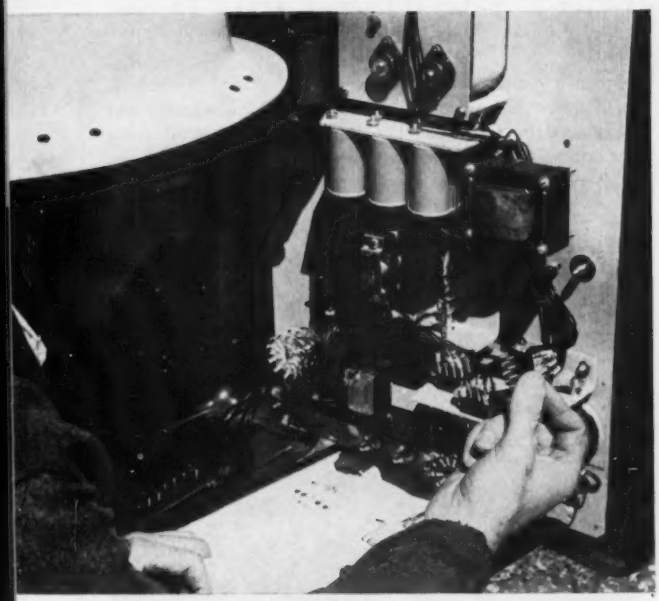
OTHER NEW FEATURES that mean increased dependability, accuracy, and economy include quickly interchangeable plug-in control components; internal channel design for easier, safer untanking by one man; and a larger, clearer tap-position indicator for improved visibility. These features, shown in detail on these pages, make this the most advanced step regulator on the market today.

UP TO 50% SAVING in first cost, compared with all other types of feeder or station regulating equipment, is an additional benefit of the new G-E ML-32 step regulator. A complete line is available —25 to 167 kva and in five voltage classes.

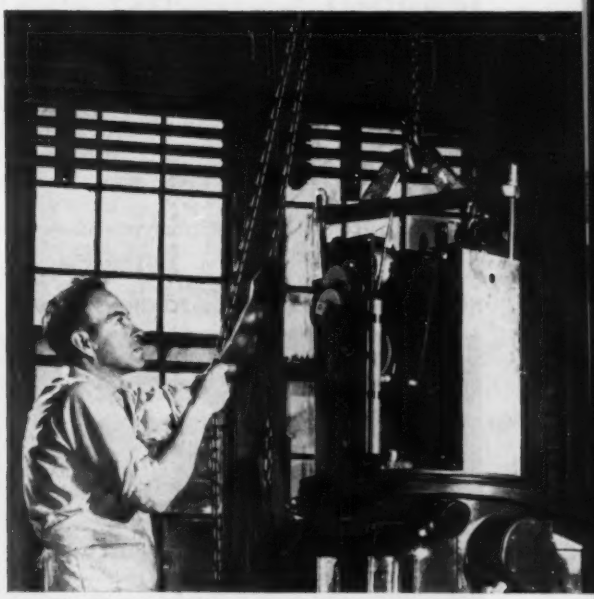
COMPLETE INFORMATION is contained in a new bulletin, GEA-5752. For your copy, contact your G-E Apparatus Sales Representative, or write to General Electric Company, Section 423-14, Schenectady 5, N. Y.

Progress Is Our Most Important Product

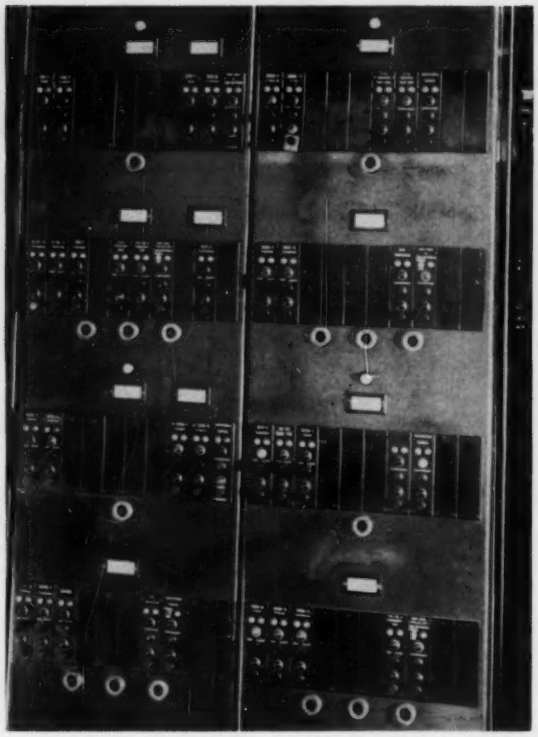
GENERAL ELECTRIC



NEW PLUG-IN COMPONENTS mean faster, more economical maintenance. Voltage-regulating relay, line-drop compensator, time-delay relay, and the control panel itself all have quickly removable plug-in connectors.



NEW EASY UNTANKING speeds maintenance. Entire regulator is a one-piece assembly mounted between protective supporting channels. Lifting eyes at top of channels allow quick, safe removal by one man.



OLD CONTROL BOARD HAD 4 CONTROL POSITIONS A PANEL

RELAYS WERE INSTALLED ON BACK OF CONTROL PANEL

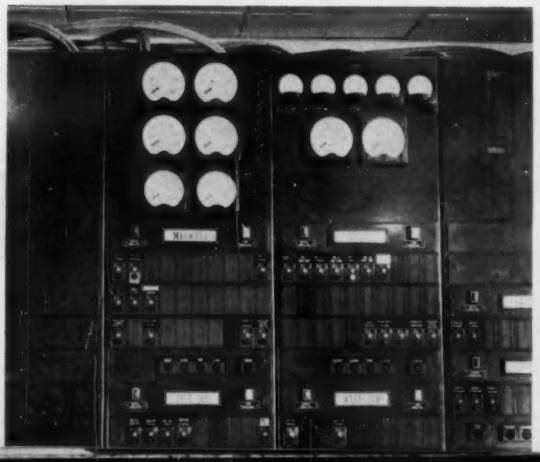
Design Compact Supervisory Control Panels

Supervisory control boards have been compacted into 25% of the space they formerly occupied in the Indianapolis Power & Light Co's load dispatcher's office by removing the relays from the backs of control panels and installing them in an out-of-the-way space adjacent to the dispatcher's office.

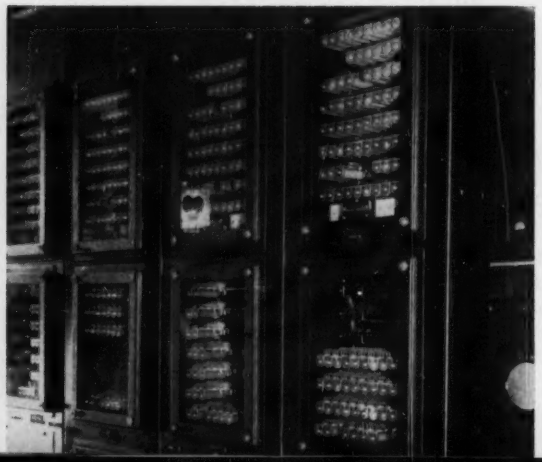
Formerly, controls for only four substations could be put on a panel because of the space required for relays. In the new arrangement, controls for 16 substations can be placed on each panel. Control cables extend from the control panel to the relays in the out-of-the-way space. Only short lengths are required.

(*More How To on page* 114)

NEW CONTROL BOARD HAS 16 POSITIONS A PANEL

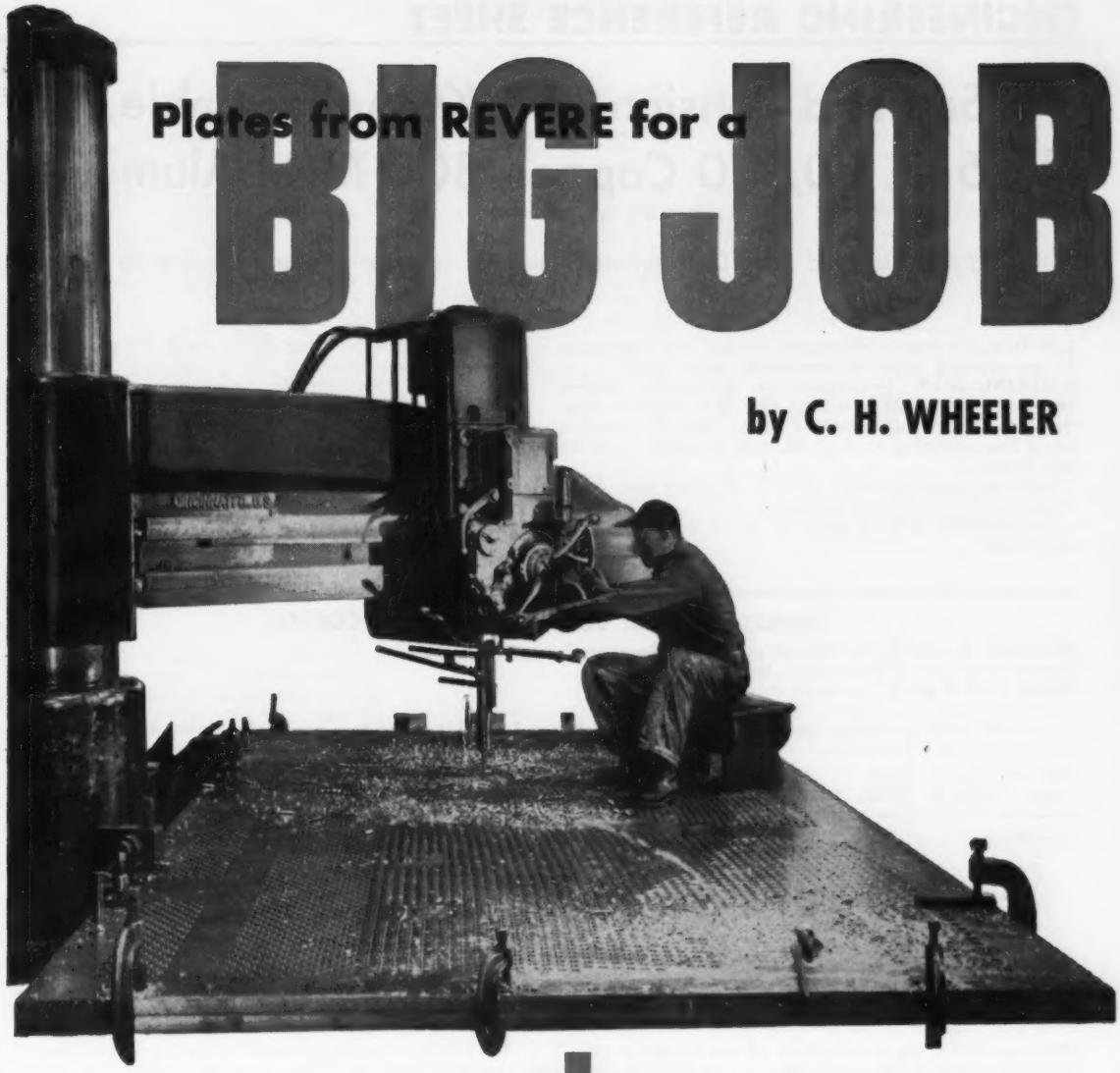


RELAYS ARE INSTALLED IN OUT-OF-THE-WAY SPACE



Plates from REVERE for a BIG JOB

by C. H. WHEELER



Here you see two rolled Muntz Metal condenser plates, being drilled simultaneously in the plant of the C. H. Wheeler Manufacturing Co., Philadelphia 32, Pa. The plates were supplied by Revere. They measure 100-¾" x 203-¾" x 1-½" thick. Four plates were supplied for a Wheeler 2-pass divided water box unit having 95,000 sq. ft. of condensing surface. The overall length of the condenser, including water boxes, is 48 ft., and overall height, including steam dome and hot well is 34 ft.

Revere is an important supplier of plates and tubes for condensers, heat exchangers, and similar equipment, shipping to all parts of the country. Collaboration on alloy selection and specification is freely available. Just get in touch with the nearest Revere Sales Office.

COPPER ★ BRASS ★ 18 01 ★ REVERE ★ ALUMINUM

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y.

Sales Offices in Principal Cities, Distributors Everywhere

Sag and Tension of 5-Kv Aerial Cable, No. 6, 3, 1/0, 4/0 Copper, 300 Mcm Aluminum

Data are adapted from Distribution Standards of New England Electric System

1. SCOPE. Following information explains and supplements the accompanying tables for preassembled aerial cable.

2. RULING SPAN. Determination for each section (between deadened points) should be the first step. It is equal to average span plus ⅔ the difference between average span and maximum span. This establishes which of the three sub-tables to use for each section.

Individual spans in excess of 125% of ruling span for a section should be deadened separately.

3. SECONDARY WIRES should be sagged not less than the aerial cable.

4. LONG SPANS exceeding 200 ft should be given special engineering consideration.

5. MAXIMUM TENSIONS for design purposes occur at 0 F, ½-in. ice, 4-lb wind, and maximum sags occur at 32 F, ½-in. ice, no wind.

6. BASIC CONSIDERATIONS included are maximum factor of safety, proper clearance from other conductors in same span and appearance.

Note that maximum tensions are well below 60% of the breaking strength. This extra strength provides greater protection against falling tree limbs.

TABLE 1. SINGLE CONDUCTOR NO. 6 COPPER

Messenger: ⅜ in. 40% High Strength Copperweld; Breaking Strength 10,460 lb.
Conductor: One No. 6 Solid Copper, Unshielded.
Weight: 0.622 lb per ft—for complete assembly.

	Ruling Spans 75 to 115 Ft				Ruling Spans 116 to 160 Ft				Ruling Spans 161 to 200 Ft			
For Temp., deg F	30	60	90		30	60	90		30	60	90	
String. Tension, lb	1,000	780	630		1,240	1,035	880		1,710	1,450	1,245	
Span, ft	Stringing Sag, in.			M. V. Sag *	Stringing Sag, in.			M. V. Sag *	Stringing Sag, in.			M. V. Sag *
50	2	3	4	4								
75	5	7	8	10								
100	9	12	15	17	8	9	10	12				
125	15	19	23	27	12	14	17	19	9	10	12	14
150	...	...	...	...	17	20	24	27	12	15	17	21
175	...	...	...	...	23	27	33	37	17	20	23	28
200	...	...	...	...	...	...	...	...	22	25	30	37
Max. Tension, lb †	1,980 (all spans)				2,450 (all spans)				3,615 (all spans)			

*Maximum vertical sag, in., with 0.5-in. ice and no wind at 32F.
†Maximum tension, lb, (all spans) with 0.5-in. ice and 4-lb wind at 0F.

TABLE 2. THREE CONDUCTOR NO. 3 COPPER

Messenger: ⅜ in. 40% High Strength Copperweld; Breaking Strength 10,460 lb
Conductor: Three No. 3 Copper, Non-Shielded
Weight: 1.55 lb per ft—for complete assembly

	Ruling Spans 75 to 115 Ft				Ruling Spans 116 to 160 Ft				Ruling Spans 161 to 200 Ft			
For Temp., deg F	30	60	90		30	60	90		30	60	90	
String. Tension, lb	1,850	1,600	1,400		2,210	2,000	1,820		2,900	2,620	2,350	
Span, ft	Stringing Sag, in.			M. V. Sag *	Stringing Sag, in.			M. V. Sag *	Stringing Sag, in.			M. V. Sag *
50	3	4	5	5								
75	8	9	10	11								
100	13	15	17	19	11	12	14	15				
125	21	24	27	30	17	18	21	23	13	14	16	18
150	...	...	...	...	24	26	30	33	18	20	23	26
175	...	...	...	...	33	36	41	45	25	27	31	36
200	...	...	...	...	...	...	...	...	32	35	40	47
Max. Tension, lb †	2,980 (all spans)				3,680 (all spans)				4,555 (all spans)			

*Maximum vertical sag, in., with 0.5-in. ice and no wind at 32F.
†Maximum tension, lb, (all spans) with 0.5-in. ice and 4-lb wind at 0F.

TABLE 3. THREE CONDUCTOR NO. 1/0 COPPER

Messenger: ⅜ in. 40% High Strength Copperweld; Breaking Strength 10,460 lb.
Conductor: Three No. 1/0 Copper, Shielded
Weight: 2.63 lb per ft—for complete assembly

	Ruling Spans 75 to 115 Ft				Ruling Spans 116 to 160 Ft				Ruling Spans 161 to 200 Ft			
For Temp., deg F	30	60	90		30	60	90		30	60	90	
String. Tension, lb	2,920	2,620	2,370		3,035	2,815	2,630		3,480	3,280	3,110	
Span, ft	Stringing Sag, in.		M. V. Sag *		Stringing Sag, in.		M. V. Sag *		Stringing Sag, in.		M. V. Sag *	
50	3	4	5	5								
75	8	9	10	10								
100	13	15	17	19	12	14	15	16				
125	20	24	27	29	20	22	24	26	18	19	20	22
150	...	...	...	...	29	32	34	37	26	27	29	32
175	...	...	...	...	40	44	47	50	35	37	39	44
200	...	...	...	...	...	...	...	...	45	48	51	57
Max. Tension, lb †	3,920 (all spans)				4,330 (all spans)				5,050 (all spans)			

*Maximum vertical sag, in., with 0.5-in. ice and no wind at 32F.
†Maximum tension, lb, (all spans) with 0.5-in. ice and 4-lb wind at 0F.

TABLE 4. THREE CONDUCTOR NO. 4/0 COPPER

Messenger: ½ in. 30% E.H.S. Copperweld; Breaking Strength 20,450 lb
Conductor: Three No. 4/0 Copper, Shielded
Weight: 3.49 lb per ft—for complete assembly

	Ruling Spans 75 to 115 Ft				Ruling Spans 116 to 160 Ft				Ruling Spans 161 to 200 Ft			
For Temp., deg F	30	60	90		30	60	90		30	60	90	
String. Tension, lb	3,800	3,500	3,000		5,020	4,570	4,200		6,300	5,800	5,400	
Span, ft	Stringing Sag, in.		M. V. Sag *		Stringing Sag, in.		M. V. Sag *		Stringing Sag, in.		M. V. Sag *	
50	4	4	5	4								
75	8	9	10	10								
100	14	16	18	17	11	12	13	13				
125	22	25	29	27	17	18	20	21	13	14	16	17
150	...	...	...	...	24	26	28	30	19	20	22	24
175	...	...	...	...	33	35	38	41	25	28	30	33
200	...	...	...	...	...	...	...	...	33	36	39	43
Max. Tension, lb †	5,260 (all spans)				6,570 (all spans)				8,060 (all spans)			

*Maximum vertical sag, in., with 0.5-in. ice and no wind at 32F.
†Maximum tension, lb. (all spans) with 0.5-in. ice and 4-lb wind at 0F.

TABLE 5. THREE CONDUCTOR 300 MCM ALUMINUM

Messenger: ½ in. 30% E.H.S. Copperweld; Breaking Strength 20,450 lb
Conductor: Three 300 Mcm Aluminum Shielded
Weight: 2.95 lb per ft—for complete assembly

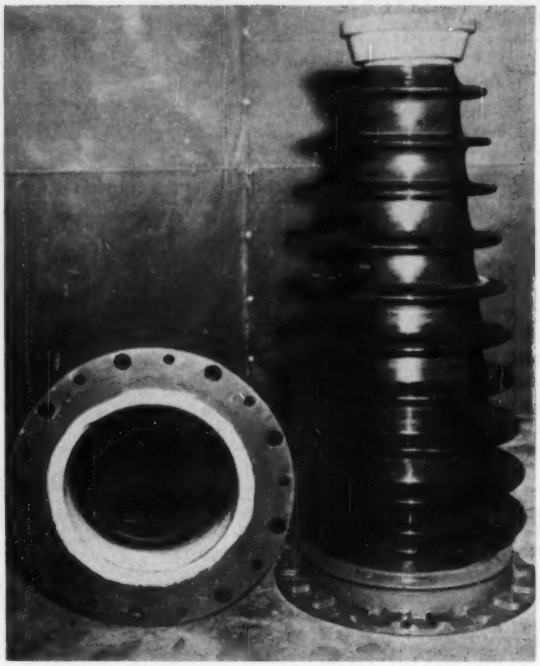
	Ruling Spans 75 to 115 Ft				Ruling Spans 116 to 160 Ft				Ruling Spans 161 to 200 Ft			
For Temp., deg F	30	60	90		30	60	90		30	60	90	
String. Tension, lb	3,830	3,370	2,950		4,770	4,330	3,920		5,680	5,200	4,780	
Span, ft	Stringing Sag, in.		M. V. Sag *		Stringing Sag, in.		M. V. Sag *		Stringing Sag, in.		M. V. Sag *	
50	3	3	4	4								
75	7	7	8	9								
100	12	13	15	16	9	10	11	12				
125	19	20	23	25	15	16	17	19	12	13	14	16
150	...	...	...	...	21	23	25	28	17	19	21	24
175	...	...	...	...	29	31	34	38	24	26	28	32
200	...	...	...	...	...	...	...	...	31	34	37	42
Max. Tension, lb †	5,200 (all spans)				6,420 (all spans)				7,620 (all spans)			

*Maximum vertical sag, in., with 0.5-in. ice and no wind at 32F.
†Maximum tension, lb, (all spans) with 0.5-in. ice and 4-lb wind at 0F.

SUBSTATION—Maintenance

Capacitor Shell Converted to 138-Kv Bushing

LEWIS GOODWIN, Division Substation Supervisor,
JAMES H. CRAVENS, Station Man, Indiana & Michigan Electric Co, Marion, Ind.



The porcelain shells of 138-kv cable-type coupling capacitors, following breakdown of the cable insulation or cracking of the cable's lead sheath, have been adapted by the Marion-Muncie division for reuse as 138-kv bushings. The shells have approximately the same dimensions as the upper portion of 138-kv bushings.

As attempts to repair the capacitors were less than satisfactory, they would have been junked. But, as any means of salvage is worth consideration, an attempt was made to adapt the capacitor bushings for replacements on oil circuit breaker bushings. The capacitor shells have solid bases, not drilled as a bushing shell.

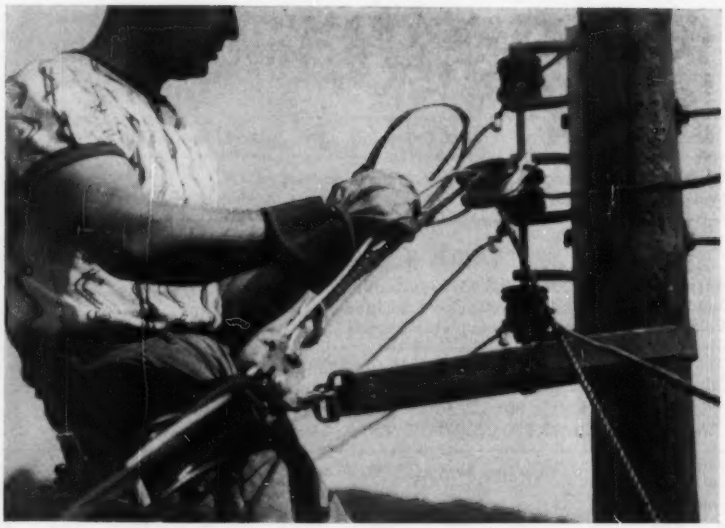
Two methods of adaptation were devised. One involved removal of the cemented-on bottom flange and its replacement with the flange from a cracked 138-kv bushing shell. The second method was drilling the capacitor base to fit the bushing base. This required drilling nine 1 5/6-in. holes in the ring for the supporting flange bolts and spacers.

About 4 man-hours are required to convert each capacitor shell to a 138-kv bushing by either method. But the conversion saves the purchase price of a replacement shell for an oil circuit breaker bushing which costs approximately $700.

DISTRIBUTION—Construction

Service Drop Work Made Safer, Easier

J. SHERMAN PAYNE, Appalachian Electric Power Co, Roanoke, Va.

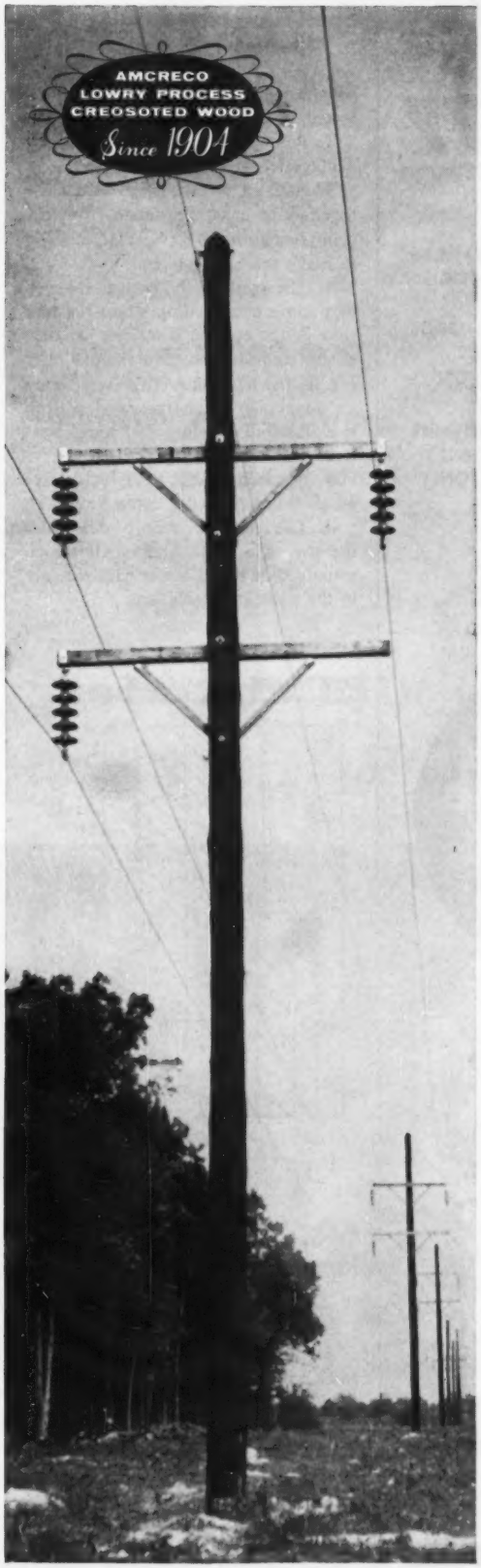


Use of a take-off insulator as a threader, guide, and/or pulley has proved safer and easier than former methods of installing, dead-ending, replacing, or removing service drops in the Roanoke District.

A lineman on a pole used to have a hard time installing individual wires or 3-wire twists, especially when clearances were close. He had to pull up these wires with a hand line and hold them in position for making connections, all the while keeping the service-drop wires out of the primaries.

Now a take-off insulator is attached to the pole or secondary rack. The hand line, attached to the service drop, is threaded through the insulator, so that a helper on the ground can pull the service drop taut by hand or with a come-along. By these means, or by looping the hand line around the insulator, the man on the pole can make connections without the old difficulties. When aluminum twist is used, the ground and supporting wire can be attached directly to the in-

(*Continued on page* 116)



Why Creosote is Still the Miracle Wood Preservative

Creosote contains not just one but over one hundred ingredients that are toxic to insects, fungi and all other natural enemies of wood. That's one reason why it has been and still is the most effective wood preservative.

Of course, effective creosote treatment depends on the method of application. There must be careful scientific control at every step in the pressure treating process. During application, the preservative must be measured by precise equipment as it is forced into the wood. Final retention, distribution and concentration must be checked continually to assure the buyer of the best possible product. *This is the type of treatment that you get from Amcreco.*

If you've never been an Amcreco customer or if you've never profited by our years of experience and strategically located treatment plants and sales offices, contact us on your next job. We would appreciate an opportunity to quote your needs.

AMERICAN CREOSOTING CORPORATION

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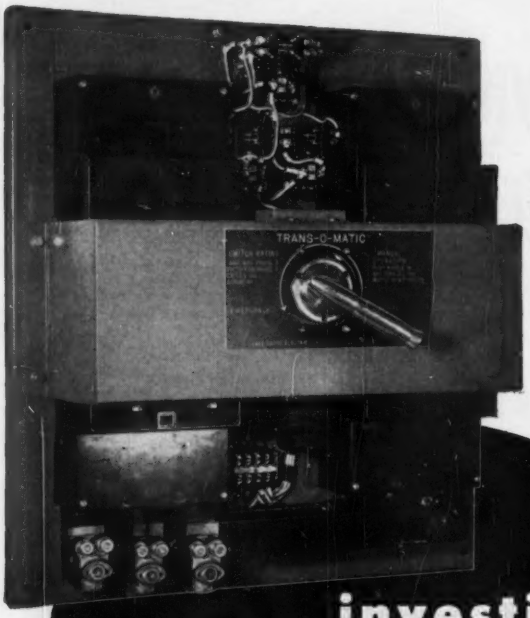
Georgia Creosoting Company
Kettle River Company

GENERAL OFFICES: LOUISVILLE 2, KENTUCKY

if YOU'RE responsible for POWER CONTINUITY



TOTAL FAILURE PROTECTION

PARTIAL VOLTAGE FAILURE PROTECTION

POSITIVE NORMAL OR EMERGENCY POSITIONS ONLY

investigate

TRANS-O-MATIC

AUTOMATIC TRANSFER SWITCHES

Trans-O-Matic's compact, failure-proof design employs two standard circuit breakers, one from the normal and one from the emergency source, either of which will supply the load. Relay-actuated motor operates circuit breakers for positive mechanical transfer with continuous service in normal or emergency position. Available in capacities to 600 volts, 800 amps, interrupting capacities to 50,000 amps RMS. Prompt delivery in most sizes.

OPTIONAL FEATURES

Adjustable time delay on restoration to 20 minutes • Engine starting contact • Test pushbutton • Pilot lights for switch position • Special enclosures

LAKE SHORE *Electric* **CORPORATION**

BEDFORD, OHIO

Shell Converted

(*Continued from page* 114)

sulator and the hand line can be released.

The new procedure has these advantages:

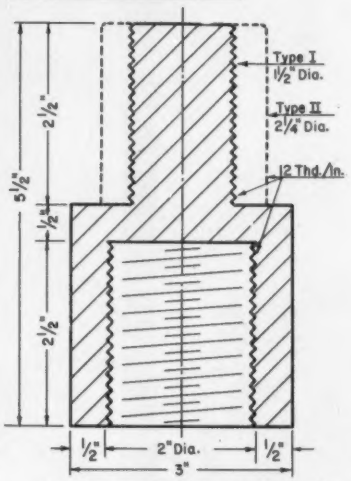
1. Ends of the wires are held close together at a safe distance from the primaries until the serviceman is ready to make the connections.

2. The man on the pole is relieved of pulling and holding strains as tension in the service drop can be produced and held by the helper who can tie the hand line. This is certainly an advantage when the service drop is a hundred or more feet long, or is strung across a busy street.

3. Serviceman has both hands free at all times to make connections.

4. The new procedure eliminates the use of a block and tackle which usually didn't pull the service directly to the point of attachment.

SUBSTATION—Maintenance



SOLID COPPER STOCK (ROUND OR HEXAGON)

Adapter Helps Utilize Interchangeable Bushings

M. L. FURGUSON, Substation Engineer, Ohio Valley Electric Corp., Madison, Ind.

An adapter, made of solid copper stock, either round or hexagonal, helps to utilize interchangeable bushings in 330-kv stations which have 1½ and 2¼-in. terminal-stud connectors. This adapter was considered desirable as the bushing was constructed for use on transformers with high-voltage lead

(*Continued on page* 121)

Operating

at 300 kv,

making 2,000,000

potential horsepower

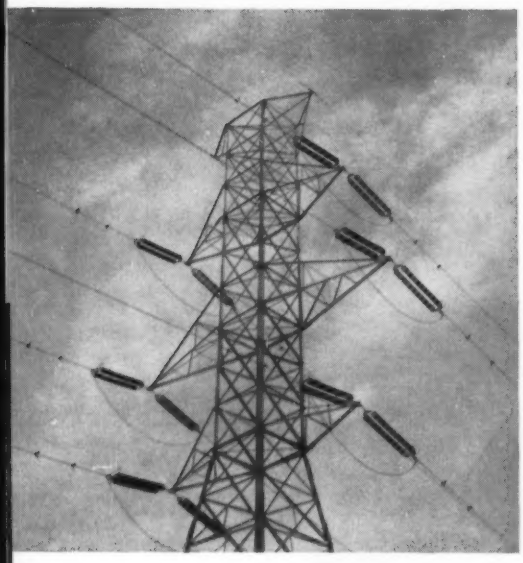
from Bersimis River

available

to Montreal

Looking down on "grand discharge" of main dam across Bersimis River.

Bersimis EHV Lines Built With O-B Insulators, Hardware



O-B insulators and hardware were used extensively in construction of the new extra high voltage lines running 400 miles from the Bersimis River to Montreal.

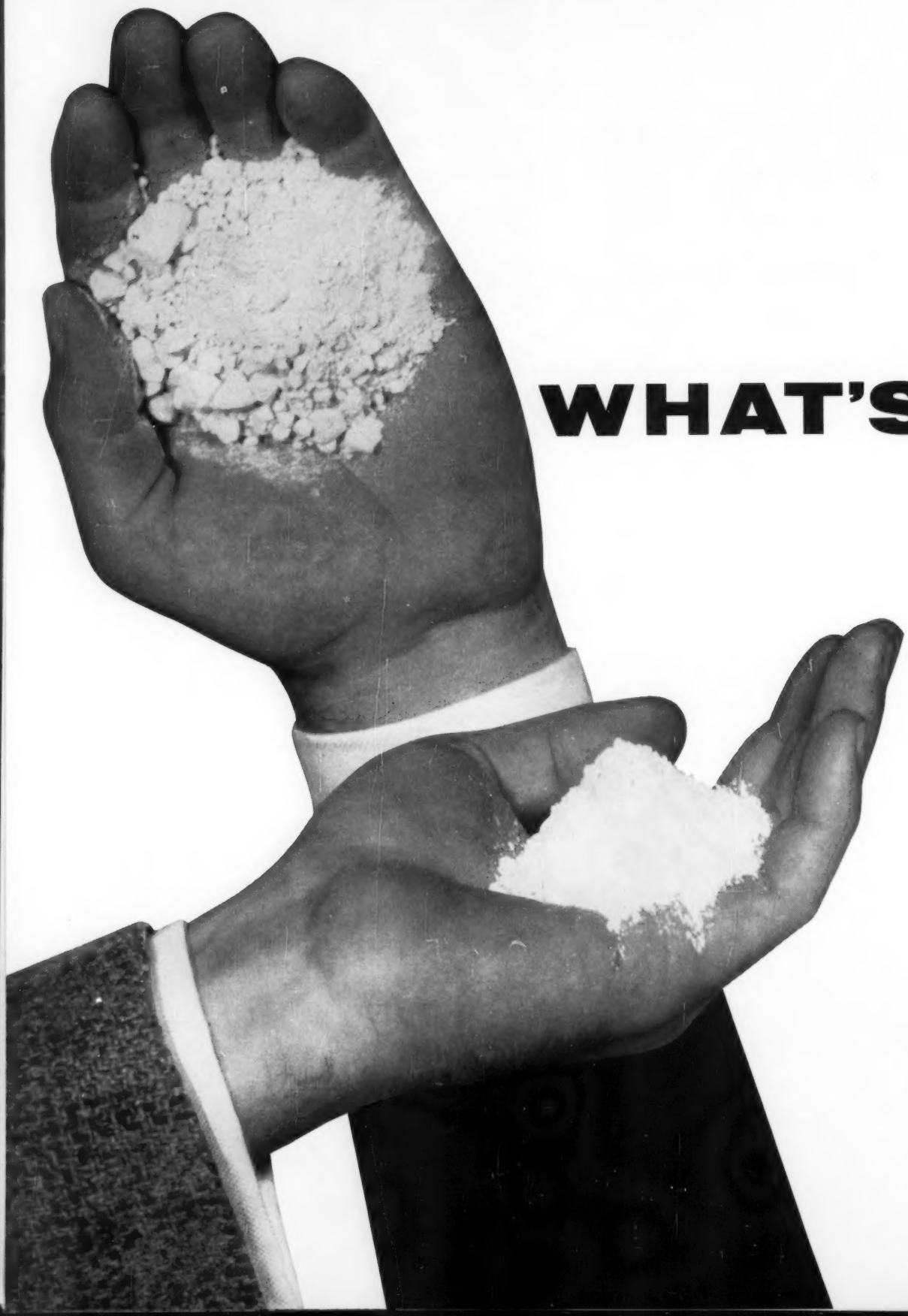
When the project is completed, an estimated 4.38 billion kilowatt hours per year will flow over the lines from Bersimis.

For such an important project, the builders of the lines selected materials of proved reliability. Much of the country covered by the lines is wilderness. Any outages or other trouble would pose a serious problem, from the standpoint of accessibility alone.

The fact that O-B insulators and hardware were selected for the Bersimis transmission lines offers further proof of their widespread acceptance by the power industry. Buyers use these O-B products with confidence, knowing that already more than two-thirds of the extra high voltage miles in North America are equipped with O-B insulators and hardware.

Ohio Brass

B


WHAT'S

THERE?

Because we find out <u>before</u> it goes into porcelain, the O-B insulators on your lines last longer

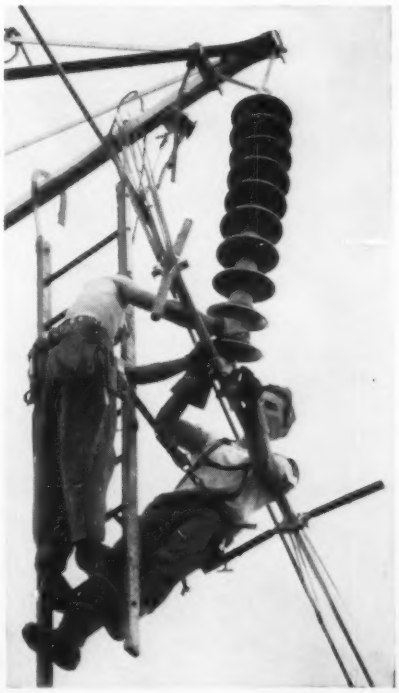
To your eyes and ours, one handful of clay, feldspar, or flint looks much like another handful.

But we know there are many variations, variations that could affect the composition of the finished porcelain, and consequently, could affect the mechanical and electrical characteristics of the insulators that go on your lines.

You want an insulator of high quality. Just as important, you want every insulator of a given design to be of *uniform* high quality.

The business of building uniform quality into O-B insulators starts before the ingredients ever go into the porcelain mix. The minute a car load of clay, for example, pulls into the plant the testing begins. We learn the moisture content, particle size, mineral structure, silica content, dry and fired shrinkage values, dry and fired modulus of rupture, loss in weight during firing, pH factor, and other key facts.

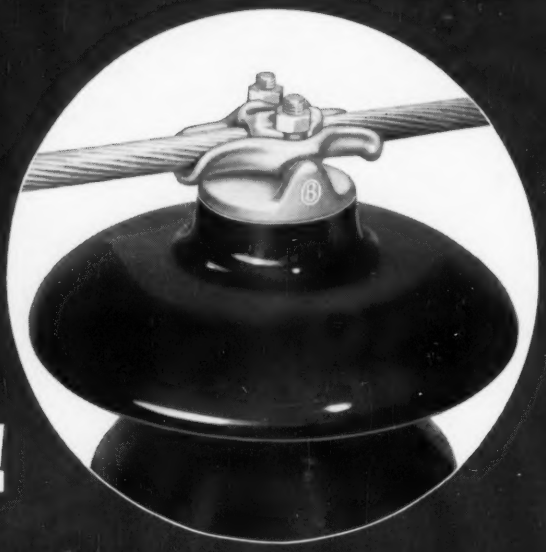
As a result of these tests, we know exactly what we're working with. We build an exact product. You receive an exact performance from the insulators you buy from Ohio Brass.



OHIO BRASS COMPANY • MANSFIELD, OHIO
CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, OHIO

Ohio Brass

half a million to prove they're right!



ALMOST 20 YEARS OF SERVICE PROVE O-B CLAMPTOPS RELIABLE, PRACTICAL AND ECONOMICAL

Yes, we know it seems like "only yesterday" but the truth is that it's been almost 20 years since O-B introduced the Clamptop method of attaching insulator to conductor. More than half a million multiparts and line posts using the clamptop feature have been placed in service. In 1937, we pointed out these advantages of the clamptop design:

1—Elimination of abrasion on conductor
2—Superior performance under vibration
3—Elimination of tie-wire failures, and outages due to such failures
4—Good radio influence characteristics
5—Elimination of uneven sag conditions
6—Greater speed and safety in hot line work

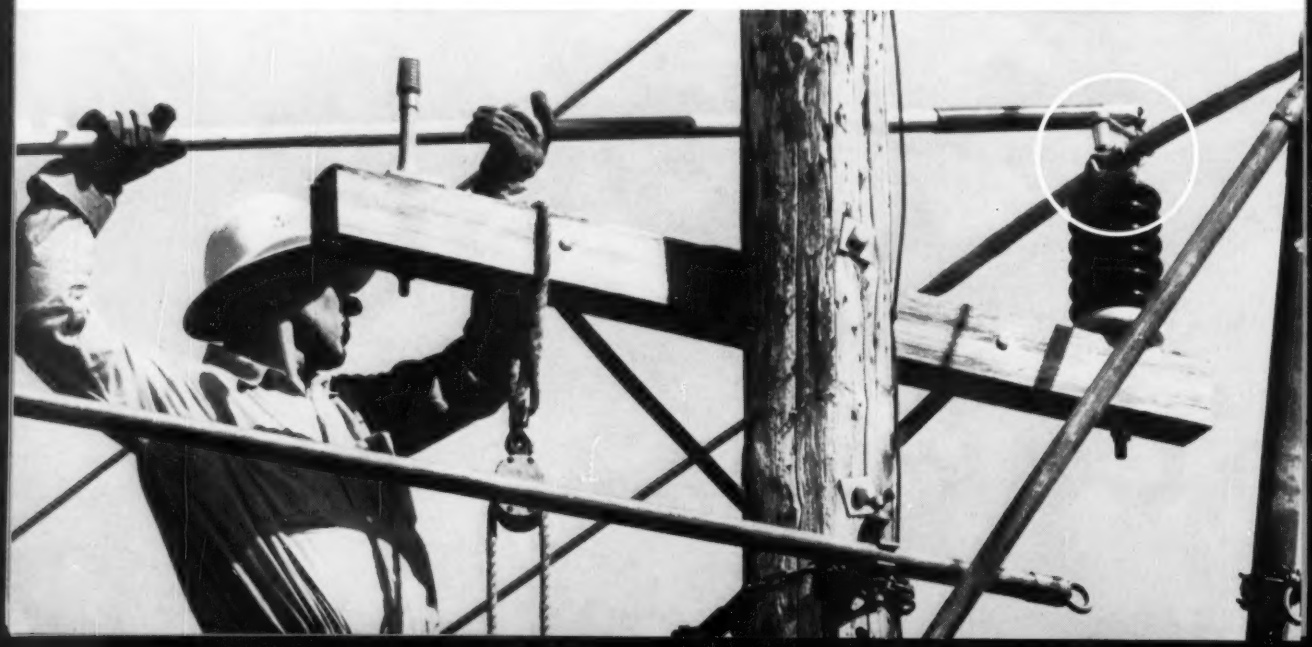
Almost 20 years later, we can not only repeat these claims, but point to the more than half million units in service which prove the benefits of the clamptop design.

If you aren't already using clamptops—available on both multiparts and line posts—don't you think it's time to give the idea serious consideration?

OHIO BRASS COMPANY • MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass

4682-H



Adapter Helps

(*Continued from page* 116)

terminated in threaded cap. On an oil circuit breaker, the use of this cap resulted in 2⅜-in. pin being the current transfer path. We did not consider this as satisfactory and used the adapter to provide a better current path. We have used them in two of our stations already and will continue their use with the interchangeable-type bushing.

DISTRIBUTION—Construction

CABLE WAS DROPPED through trench in the ice. Weight of the cable broke through the remaining thickness of the ice allowing it to sink to the bottom of the lake

Crew Lays Cable to Island Through Ice on Lake

When electrical load on an island in Gull Lake, northeast of Kalamazoo, Mich, reached the point where the cable serving it had to be replaced, the lake was frozen over. The new cable, 1,200 ft in length, weighed 13,000 lb, so that handling it on the ice would have been extremely difficult.

Consumers Power Co crews set up the cable reel on the lake shore ready for pulling cable. A drag line was run through a pulley on the island and attached to the end of the armored

(*Continued on page* 122)

MR. LINEMAN:

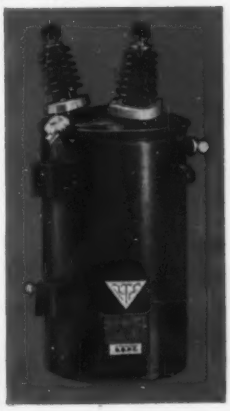
WHAT DO YOU KNOW ABOUT RT&E?

As one of the important men who keep power flowing to the nation's homes and industries, you should know something about one of America's leading suppliers of power equipment.

We are not the largest transformer builder, but we *are* one of the most conscientious. We know that your only concern is that a transformer work right, that it stand up in service and be easy to maintain. We know that extra time on our end can save *you* hours of trouble shooting.

Many of our exclusive design features are suggested by you and built for your convenience. Our externally-operated tap changer is standard equipment. You operate our dual voltage control from outside the tank, without removing the unit from the pole. Our weights are balanced for the highest load capacity per pound. These are features you want.

Next time you see "RT&E" on a transformer you install, you can be sure it'll be as trouble-free as a transformer can be.

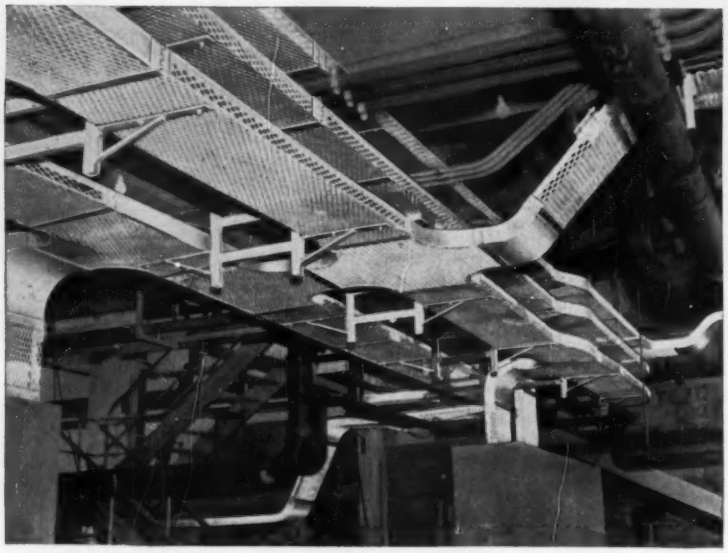


RT&E CORPORATION
WAUKESHA, WISCONSIN

Equipment to help provide power for America

YOU CAN SIMPLIFY CABLE INSTALLATIONS with COPE CABLE TROUGH

Humboldt Bay Steam Plant Pacific Gas and Electric Company
Engineers: Bechtel Corporation



Contractors and engineers everywhere are fast realizing that *more* time—more costs—are saved when Cope Cable Trough is specified.

- Cope Cable Trough goes up faster
- Cope Cable Trough simplifies designs
- Cope Cable Trough saves space

Specify Cope Cable Trough on your next job. You'll be amazed at how simple it is to install.

Tommy Cope says:
"Every minute you save on installation time increases your profit on the job."

C-E16

Our engineers are ready to work with you. Write us today for full details on Cope Cable Supporting Systems.

T. J. COPE, INC.
COLLEGEVILLE 4, PENNSYLVANIA

Cope

TEE

DROP-OUT

CABLE SUPPORTING RISER ELBOW

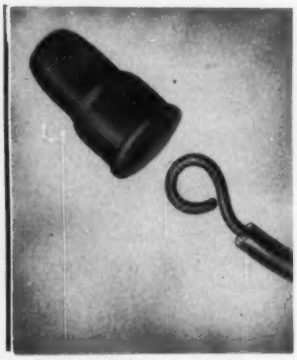
TROUGH WITH BARRIER STRIPS AND COVER

Lays Cable

(*Continued from page* 121)

cable. A winch pulled the cable over the ice to the island. A trench was cut through the top 12 in. of ice from the mainland to the island, and the cable was dropped into it. The weight broke through the remaining ice thickness, allowing the cable to sink.

GENERATION—Construction



RUBBER INSULATING CAP (actual size) covers wire eyes to prevent contact

Rubber Caps Protect Bare Ends of Control Wires

GLEN SIMMONS, Indiana & Michigan Electric Co, Muncie, Ind.

Insulating caps for covering wire eyes have proved useful to station men in the Marion-Muncie division of Indiana & Michigan Electric Co in preventing accidental contacts of bare wire ends during work on live station switchboards. The caps are small rubber nipples fitting very snugly over the wire eyes and extending ½ in. over the conductor end.

When revamping an old station or placing a new one in service, station men often leave a piece of switchboard control out of service, the wires being disconnected. To prevent accidental contacts of the bare wire end, the wire eyes used to be lifted or not made up until the apparatus was ready for service. The wire ends were taped and later cleaned before connections.

This procedure was slow and expensive, especially when the wire eyes were made up at the last minute. Today the caps reduce expensive delay.

The caps, costing only $1.40 per 100, can be reused almost indefinitely.

INSTRUMENT TRANSFORMERS

Flexibility for growing loads

For load growth to 800 amperes, Sangamo Type R Transformers ... either with or without enclosures ... give needed flexibility.

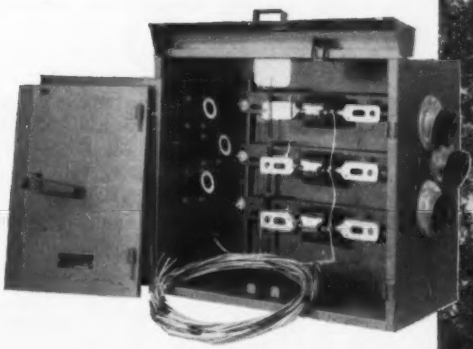
Pre-wired Metering Units usually consist of a pole top enclosure for transformers and an eye level metering unit with test switches, for either primary or secondary installation.

Transformer-Meter Mounts are single units, with both transformers and either socket or bottom connected meter, for secondary service only.

These factory assembled units eliminate the costs of "on the job" internal wiring and assembly.

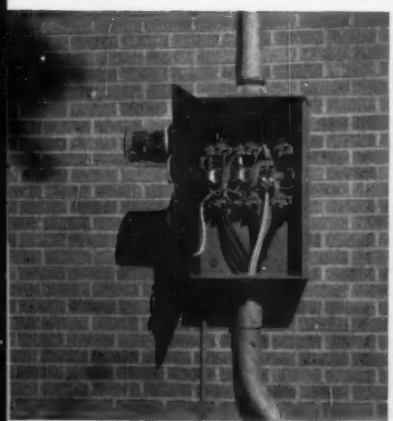
Ask your Sangamo Representative or write us for Bulletin 570 for detailed information on these economical transformer metering units.

SANGAMO ELECTRIC COMPANY, Springfield, Illinois

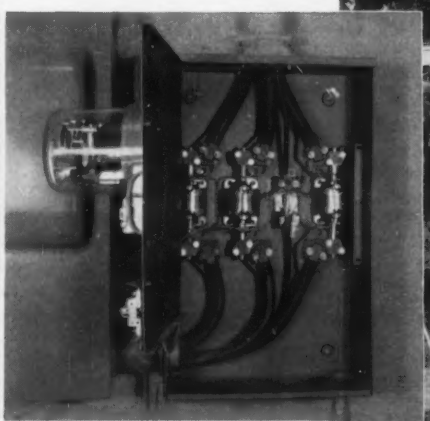


Sangamo pre-wired metering unit transformer cabinet for secondary metering of three-phase 4-wire circuits. Cabinet contains Type RF-6A Current Transformers.

Pre-wired Metering Unit—a typical convenient and economical installation.



Outdoor-installed Sangamo Transformer-Meter Mount. All necessary components and connections are contained within the factory-assembled unit.



Indoor-installed Transformer-Meter Mount with bottom connected meter and test switch.

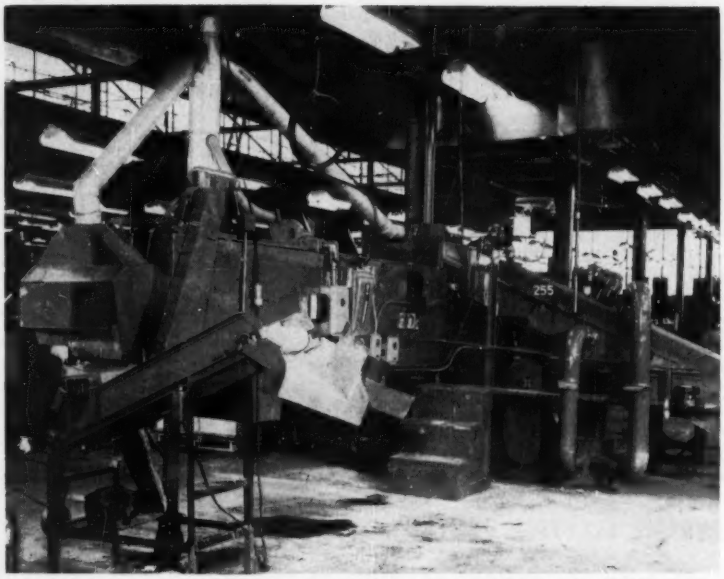
SM56-10

Far-Infrared Heat Eases Hardware Lubrication

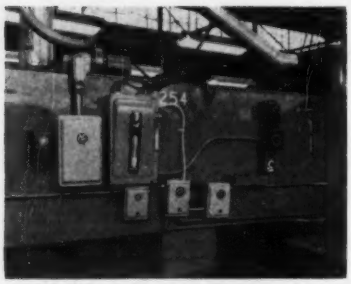
M. L. BRUCE, Power Sales Engineer, Consumers Power Co, Jackson, Mich.

Far-infrared heaters are being used to evaporate the solvent from a hardware lubricating solution at the Hancock Manufacturing Co, Jackson, Mich. The company makes automobile door latches and other door hardware. To speed up the lubricating process, lubricant is dissolved in a less viscous solvent, and the hardware is then dipped in the solution. Before the hardware is shipped, the vehicle must be removed, leaving the heavier lubricant deposited on the hardware. As the vehicle is similar to mineral spirits, it can be evaporated readily by applying sufficient heat to the dipped parts.

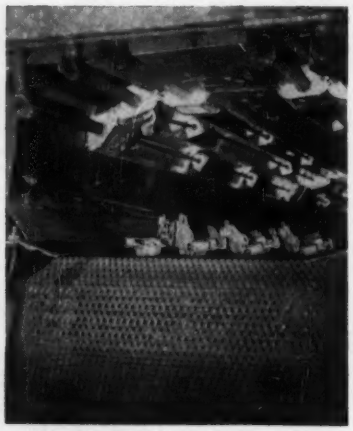
The need for a steady heat source, which could be set to any chosen temperature and controlled precisely, was solved by using electric heaters. Consumers Power Co worked with the electrical equipment contractors to help the manufacturer set up a drying oven which included the far-infrared heaters, a conveyor belt, and forced air ventilation.



ELECTRIC CONVEYOR OVEN evaporates lubricant solvent from dipped hardware but leaves the heavier lubricant. Exhaust vents remove the volatilized vehicle



MAGNETIC CONTACTOR controls 3-phase input. Adjustable thermostat is normally set to 300F, works 80% of the time with 30-sec operating cycle



2.5-KW FAR-INFRARED lamps in oven roof are rated 40 w per sq in. density

Thermostat Regulates Oven

The heaters are 5-ft, 2.5-kw units, rated at 40 w per sq in. density. Sixteen are distributed over the ceiling of the oven to assure an adequate heat level over the entire length of the conveyor. Heaters operate at 480 v, single phase but are connected to a 3-phase circuit to produce a balanced load.

The 3-phase input is controlled by a magnetic contactor and a thermostatic input controller. The controller is set to maintain a temperature of 300F, with the heaters working for 80% of the controller's 30-sec time interval. Oven temperature may be changed by a single adjustment of the input controller.

Calculations indicated that approximately 10,000 cfm of air were needed to remove the vehicle vapors adequately from the metal hardware and the oven enclosure. To exhaust the vapors completely, air is drawn from the top, the bottom, and both sides of the oven simultaneously and fed to a central duct which carries the fumes to the outside.

Use of the conveyor system has sharply reduced the handling required to lubricate the parts. After a dipping in the lubricating solution, the hardware is dried amid air movement and then conveyed into the oven. When finished parts reach the end conveyor, they are transferred to a loading conveyor and ultimately to a pallet for removal.

The infrared heating method is a safe, well regulated, and easily controllable process which leaves the finished product, with exactly the right amount of lubricant for satisfactory service, ready to be installed in the automobile. As an additional advantage, the oven is mounted on wheels and can be moved to other locations by disconnecting the power cable at the old point of use and reconnecting it at the new.

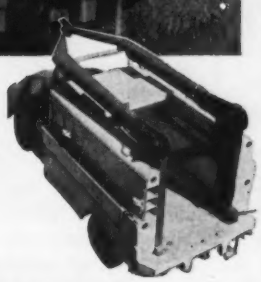
NEW DESIGN BEEFS UP DERRICK, CUTS DOWN WEIGHT

We made this new derrick with legs to please you. Fabricated and rectangular, they weigh 20 percent less than most side legs, yet they're about 25 percent stronger. The "bow-legged" shape keeps the cargo area open.

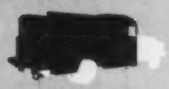
This derrick lifts 8000 pounds (has been tested at 14,000 pounds), body-loads 2,500 pounds, handles 65-foot poles. Operating range is 195°, and live-boom action gives you infinite lifting positions with a single-drum winch. *Like other Holan derricks, this one fits any body on its own supports. There is no need to rebuild or reinforce the body proper.*

There's much more to tell, so write us and ask about the Series 6700 Power Derrick.

Series 6700 Derrick mounted on Holan CLC-138 Construction Body. Notice new Holan corner window design for crew compartments.



All Holan bodies are made of hi-tensile, rust-resistant steel 20 to 25% lighter than ordinary steels.



Line construction bodies for light to heavy-duty. Crew compartments optional. Efficient tool compartments and drawers.

Service bodies for chassis up to 1½ ton. Lengths, 72", 84" and 102".

Aerial arm for spotting workmen 37 feet above ground, 9 feet below ground level. Double-basket unit extends 45 feet. Rotates 360°.

Live-boom, three-legged derrick lifts 12,000 lbs., 75-foot poles. Body-loads 5,000 lbs.

Mechanical Ladders expertly engineered and counterbalanced for effortless handling. Maximum heights from 24' to 32'. Swings 360°; angles to 72°

Portable hydraulic and mechanical earth borers. Augers for 8" to 20" diameters, depth to 8'

Hydraulic jacks, controlled from rear of truck. Rigid mounted or patented Holan self-stowing types.

Live-boom, two-legged derrick with fabricated, rectangular side legs—"bow-legged" design. Lifts 8000 lbs., 65-foot poles.

Live-boom, two-legged derrick with automatic hydraulic side-leg coupling. Lifts 6000 lbs., 70-foot poles.

Ladders to 40' with all phases completely hydraulic. Pump actuated by P.T.O. or separate engine drive with electric starter

Hydraulic towers with rotary, stationary, or transverse platforms. Exclusive box-girder telescoping mast.

J.H. HOLAN CORPORATION

4100 WEST 150TH STREET
CLEVELAND 11 OHIO

OTHER PLANTS

HOLAN CORPORATION OF GEORGIA, Griffin, Ga. • J. H HOLAN CORP., Phoenix Div., Arizona
BRANTFORD-HOLAN LIMITED, Brantford, Ontario

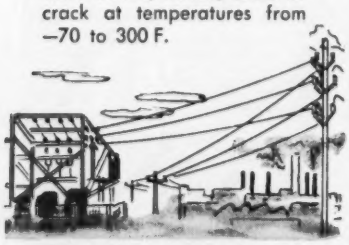
THE NAME THAT MEANS WORK SIMPLIFICATION

Reduce Insulator Leakage, Maintenance

with Dow Corning 5 Silicone Compound

Applied to insulator surfaces, grease-like Dow Corning 5 reduces electrical leakage by preventing the formation of continuous, conductive moisture films. What's more, insulators protected with this silicone dielectric require less frequent cleaning . . . When cleaning does become necessary, you need only to wipe insulators — no scrubbing, no steel wool.

Unaffected by fly ash, cement dust and other airborne contaminants, Dow Corning 5 resists moisture, oxidation, salt spray, fungus or chemical attack. Also recommended as an all-weather lubricant for switches, meters and condensers, Dow Corning 5 won't stiffen, freeze, bleed or crack at temperatures from —70 to 300 F.



Make your own test!

Send for FREE sample today

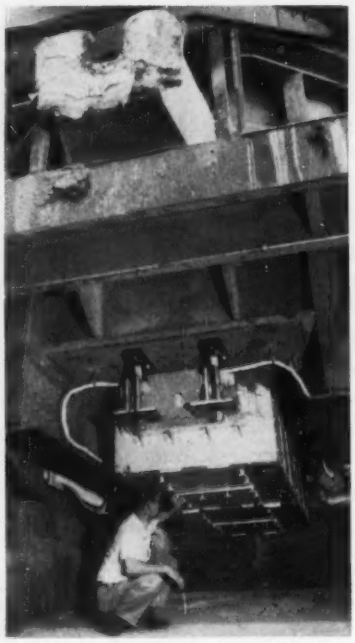
first in silicones

DOW CORNING CORPORATION
Midland, Michigan
Dept. 4411b

Induction Stirrer Improves Castings

Induction stirrer mechanisms, in their first foundry application, are being used to cut refining time and produce better castings at GE's Schenectady steel foundry. The mechanisms developed in Sweden are installed in two electric arc furnaces, one with a capacity of 25 tons, the second, 12.5 tons. All previous stirring systems have been either manual or mechanical and have been used with relatively limited effectiveness in steel mills for the production of ingots.

The induction stirrer is suspended about one inch below the stainless steel furnace floor and resembles one segment of a large, two-phase induction motor stator. When low frequency ac is fed into the water cooled stator winding, the resulting magnetic field sets up eddy currents in the molten metal above. These eddy currents provide the stirring force for the mixing action. Each stirrer, rated at 400 kva at 340 v, can be operated at full load, 20% overload, or half load. Consumption is approximately 10 kwhr per ton.



ATTACHED TO BOTTOM of arc furnace, water-cooled unit resembles 2 phase stator. Molten metal acts as rotor

Process Cuts Chemical Impurities

The new induction stirrers will almost completely eliminate such impurities as phosphorus and silicates, with very little loss of metal. Sulphur impurities are reduced to about one-third of the best levels attainable in conventional practice. The uniform furnace temperatures produced by the stirring action will insure a better control of grain size in austentic steel. As chemical stratification is greatly reduced by the more thorough mixing, sample analyses will yield results which are representative of the entire heat.

To protect the stirring unit coils from overheating, the furnaces incorporate a temperature monitor system, comprised of a series of thermistors installed in the furnace bottom and in the stirring mechanism housing. When the temperature at either site exceeds a predetermined, maximum safe temperature, the monitor automatically stops the stirrer and sounds either a horn or a bell, according to the location of the "hot spot."

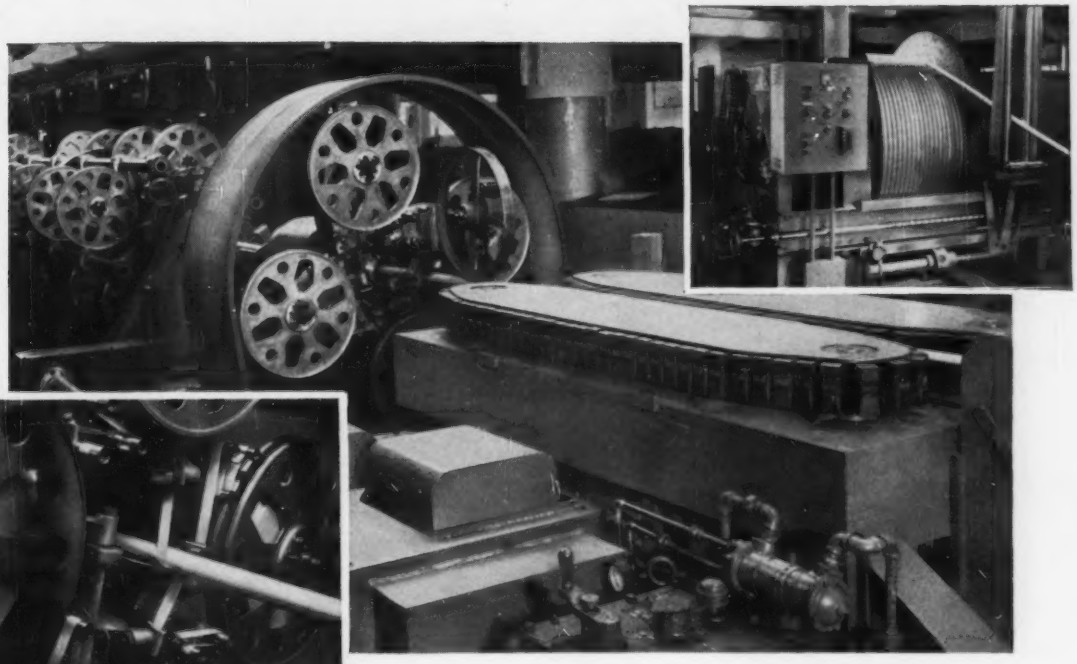
A signal light system indicates the nature of the trouble. The exact location of the defect may be determined connecting a panel board to the thermistors and checking the thermometer readings.

Energy for both stirrers is obtained from a specially built single-phase, 1.4-cycle, commutator type generator, rated at 250 kva, with a power factor of 0.2. The generator is driven by a 280-hp, 60-cps, 440-v, 1,170-rpm, 3-phase, slip ring, induction motor. Excitation is provided by a specially built phase and frequency converter, with rotating primary windings and a stationary secondary.

By reversing the input to the stirrer, the metal flow in the furnaces may be directed either at the slag door for slag-off operation or at the pouring spout on the opposite side of the furnace.

On the larger, 13.5-ft diameter furnace, the weight of the stirrer assembly, including the coils and the container, will be approximately 17,000 lbs. The stirrer unit on the smaller, 11-ft diameter furnace weighs about 13,000 lbs. Cost of the induction stirrers is approximately $200,000.

ROEBLING INVESTS IN YOUR FUTURE



MAIN PICTURE: Endview of taping machine showing caterpillar pull out

INSET AT UPPER RIGHT: Controlled tension take-up

INSET, ABOVE: Taping heads controlled tension

New, improved paper taping machines bring you far superior "paper and lead" cables

SHOWN ABOVE is one of the most modern paper taping machines in production today . . . applying tape to Roebling Paper Insulated Cables with an accuracy that brings new measures of insulating efficiency.

Outstanding features of these machines are:

★ Caterpillar pull-out which prevents distortion of paper tapes;

★ Improved gearing and "squirrel cage" machine design which eliminates backlash and insures uniformity in taping;

★ Controlled tension take-up which can be varied to suit the individual needs of each cable;

★ Controlled tension pay-off, coordinated with caterpillar pull-out;

★ Taping heads with automatic tension control.

The installation of this machine is just one part of a modernization program designed to give you paper insulated lead covered cables of outstanding dependability and service economy.

Let us consult with you on your individual cable problems. Our engineering and metallurgical staffs are always available.

ROEBLING ELECTRICAL WIRES AND CABLES ARE AVAILABLE WITH EITHER COPPER OR ALUMINUM CONDUCTORS

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 11-15 STILLING ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 2340 GLENDALE-MILFORD RD., EVENDALE • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • PITTSBURGH, 1723 HENRY W. OLIVER BLDG. • SAN FRANCISCO, 1740 17TH ST. SEATTLE, 900 1ST AVE. S. • TULSA, 331 N. CHEYENNE ST. • EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK 6, N. Y.

FWD delivers more traction with true four wheel drive...

because both power and weight are proportioned!

FWD sets poles where ordinary trucks can't go.

No need to skip the tough ones with new FWD.

Heavy-Duty Vehicle Specialists

THE FOUR WHEEL DRIVE AUTO COMPANY

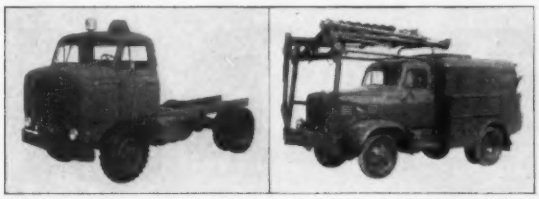
There's a reason why utility men call FWDs "the trucks that get going where others have to quit." It's because they have the power and traction of *true* four wheel drive!

This is full time four wheel drive, not just a conversion kit. And the difference is important! FWD not only powers both axles all the time but properly divides driving torque according to the work to be done by each axle. This is the only truck that uses every pound of weight to produce traction.

You see FWD outperform on day-to-day construction and maintenance jobs. And in rugged weather or off-highway terrain they carry on where other trucks have to quit. New FWD units dig more holes, set more poles than converted or conventional drive trucks because they're not limited to paths of least resistance. Your only real control over weather and terrain is powerful new FWD!

FWD saves time, goes direct to the job anywhere.

Name your job...
do it better with FWD!

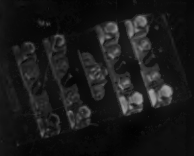


FWD makes a full line of heavy-duty utility trucks including the "Rhino" front-mounted derrick and digger truck, regular and Cab-Over-Engine models with both four and six-wheel drives. These can all be fitted with bodies, PTO and equipment to match your requirements. Every model is engineered by the FWD utility division to fit the special requirements of utility duty.

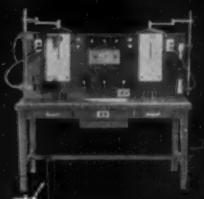
CLINTONVILLE, WISCONSIN • *Canadian Factory* • KITCHENER, ONTARIO

Check with Superior on...

SWITCHES

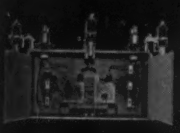


BLOCKS



TABLES

SOCKET EQUIPMENT

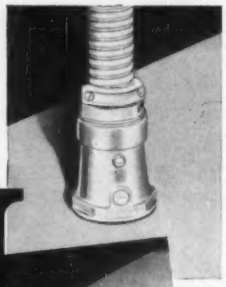


ENCLOSURES of all sizes

SUPERIOR
SWITCHBOARD & DEVICES CO.
CANTON, OHIO
A subsidiary of
The Union Metal Manufacturing Company

in a FIX for FITTINGS?
standards or specials... get them faster from

PLM



• Wet locations... dry locations... for terminations with potheads or without them... whatever your needs for armored cable terminating fittings or splices may be, you'll find answers, *fast*, from PLM.

PLM Catalog 301 lists and illustrates fittings for all types of installations to 15 kv, to meet standard as well as special requirements. Listed also are PLM Splicing and Terminating Kits to speed up the job... insure complete, correct materials for every armored cable splice and termination, as well as for splices in non-metallic and lead-covered cable. Ask for your copy.

PLM PRODUCTS, INC. · 3873 West 150th Street · Cleveland 11, Ohio
WIRE AND CABLE FITTINGS AND ACCESSORIES

INDUSTRIAL BRIEFS

Remote control pushbutton starters used on six ball mill grinder drive motors have eliminated false motor starts and increased plant operating efficiency at the Diamond Portland Cement Co, Middle Branch, Ohio. Housed in individual, steel enclosed cabinets, the starters are installed in a separate room, away from the grinders and the areas of heavy dust concentration require much less maintenance. The pushbuttons are located near the grinders and allow the operators to start or stop the 440-v synchronous motors quickly and easily. Automatic field control begins when the "start" pushbutton is pressed. Field excitation is applied at the moment when the motor is most easily locked into synchronism. If the motor is pulled out of step by a momentary overload or voltage dip, the controller automatically removes the field excitation and then reapplies it at the proper time, reducing motor "downtime" significantly. Before the new equipment was installed, three separate manual operations were required to start and synchronize each of the six grinder drive motors.

An industrial TV camera used to simplify inspection of chrome-plated metal blades at the American Can Company's Cincinnati Machine Shops has doubled the production rate and improved product quality simultaneously. Inspectors can now sit down on the job, yet inspect more pieces with a significant improvement in accuracy and less fatigue. The closed circuit TV system monitors the scraper blades through a microscopic lens. The image, enlarged 288 times, is projected on the screen of a 21-inch TV receiver located a few feet away. The thin scraper blades, each several feet long, are used on American Can Co's lithography presses. A microscopic inspection is necessary to detect any tiny imperfections which might impair the efficiency of the blades. After magnification, the blade segment appearing on the TV screen is a horizontal bar approximately four inches wide. The screen is marked with a series of vertical lines to indicate the tolerance limits. Before the new system was installed, inspectors checked the blades peering through a 30-power microscope.

MORE CAPACITY

Chase® Bus Conductors carry 20% more load!

Those ventilating holes in Chase Ventilated Square Tube Copper Bus Conductor help dissipate heat... and increase current-carrying capacity up to *20%*. And ventilated square tube bus conductor can *also* save you as much as *36%* in weight of copper as compared to flat rectangular bus bars!

Because of its rugged, square cross section configuration, Chase Bus Conductor is much stronger. It withstands the tremendous stress of heavy short circuits, permits longer spans between supports.

For more information, send for the free Chase Bus Conductor brochure.

Chase®

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass, Copper & Stainless Steel

Atlanta	Chicago	Denver	Indianapolis	Minneapolis	Philadelphia
Baltimore	Cincinnati	Detroit	Kansas City, Mo.	Newark	Pittsburgh
Boston	Cleveland	Grand Rapids	Los Angeles	New Orleans	Providence
Charlotte	Dallas	Houston	Milwaukee	New York	Rochester
	St. Louis	San Francisco	Seattle	Waterbury	

BROOKS WALLACE VENNARD

Electric Heat Conference . . .

. . . designed to bring into focus problems of selling and serving these new loads. Electrical World-sponsored conference to feature top speakers in field

What are the problems of selling and serving new heating loads?

What are some of the solutions?

You'll find more such questions and a large variety of answers at the Electric Space Heating and Heat Pump Conference to be held at the Barbizon-Plaza Hotel in New York City December 5-6 under sponsorship of Electrical World magazine.

Industry executives will discuss load considerations, policy matters, promotional techniques, and other problems common to managements of electric companies. Topics include matters of interest to companies which now have sizable space heating and heat pump loads as well as those which anticipate them.

Among the officials slated for talks are Edwin Vennard, vice president and managing director of Edison Electric Institute; C. M. Wallace, vice president of Georgia Power Co, who's subject concerns company policies; and Paul D. Brooks, vice president, American Gas & Electric Service Corp.

The two-day conference will feature a dozen addresses, a symposium on the outlook for the heat pump and resistance heating, and panel discussions on heating promotions and how to sell heat pumps.

George S. Jones, managing director, Air Conditioning & Refrigeration Institute, will answer the question: Where is air conditioning headed? Summer peaks in the years to come will be described by M. R. Rodger, Middle West Service Co's senior marketing consultant.

An outline of what EEI is doing in the field will be presented by members of EEI's electric heating and air conditioning committee. A roundup on resistance and radiant heating prospects is scheduled by speakers from National Electrical Manufacturers Association's house heating section.

"A New Look at the Heat Pump Market" is the address slated by General Electric Co's H. M. Brundage, general manager of the Weathertron department. Another GE representative, Paul M. Augenstein, will describe the importance to utilities of reverse cycle room air conditioners. Augenstein is general manager of the firm's room air conditioner department.

The solution of heat pump problems will be explained by E. R. Ambrose, AG&E Service Corp and chairman, AEIC-EEI joint heat pump committee. And the distribution factors involved in serving heating and cooling loads is the topic of Vice President John B. Taylor, Atlantic City Electric Co.

Fischer Black, Electrical World publisher and editor, will summarize the sessions.

For accommodations address David S. Racusin, general manager, Barbizon-Plaza Hotel, 106 Central Park South, New York 19, N. Y. Registration fee is $20, which includes two luncheons, a cocktail party, and a copy of proceedings.

BRIEFS

Air-Conditioned Air Force

Westinghouse Electric Corp recently received orders for residential central air conditioning units to be installed in officers' and enlisted mens' quarters at Abilene, Texas Air Force Base. The order totals approximately $500,000, possibly the largest single such order ever placed by any purchaser, civilian or military. The units will be a type designated as ACU; they are air cooled and do not require the cooling water usually associated with central air conditioning units.

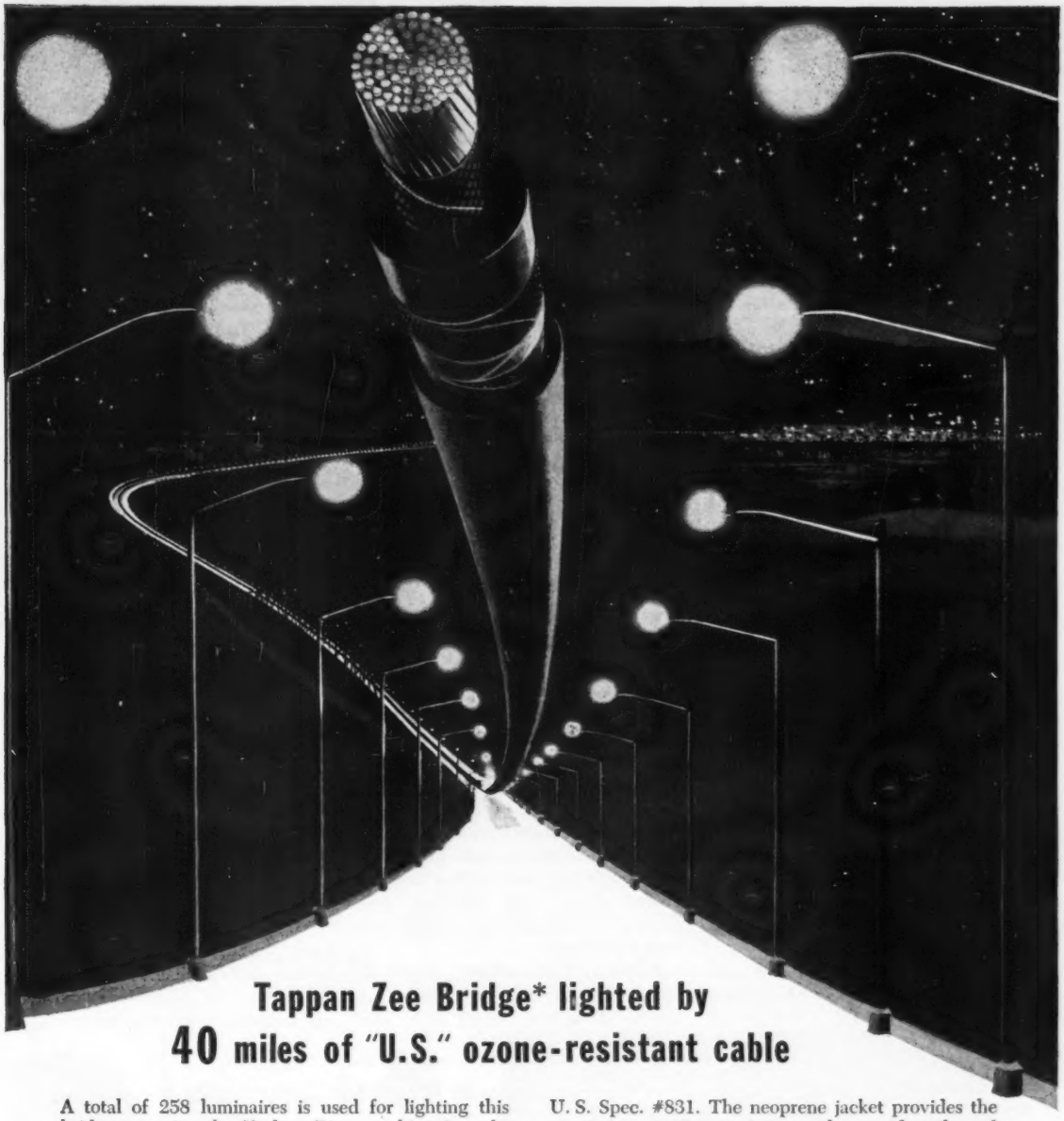
HL&PCO Getting Hot

Houston Lighting & Power Co is encouraging appliance dealers to sell portable electric heaters by tying in with HL&PCO's advertising and sales promotional support. "Reddyheat" campaign includes billboards, truck signs, TV, weekly and daily newspapers and window displays.

Gas Heats More Homes

Gas is used to heat more homes in the U. S. than any other fuel. The American Gas Association statistics show that gas provides heat for 22.5 million homes. Breakdown as follows: Gas—46%; Liquid Fuels—30%; Electricity and others—24%.

US RUBBER STREET LIGHTING CABLE



Tappan Zee Bridge* lighted by 40 miles of "U.S." ozone-resistant cable

A total of 258 luminaires is used for lighting this bridge spanning the Hudson River, making it probably the best-lighted bridge in the world. To minimize distribution costs, constant current series circuits are used.

The 40 miles of cable used on this lighting system is *ozone-resistant* "U. S." Series Street Lighting Cable, Uskorona – 2, butyl insulation, 7,500-volt shielded, U. S. Spec. #831. The neoprene jacket provides the greatest protection against weather, acids, oils and all-around abuse. Yet the cable is light in weight and easy to handle.

For electrical wires and cables to fill any requirement, to handle any wiring need, write Electrical Wire & Cable Department, United States Rubber Company, Rockefeller Center, New York 20, N. Y.

*Part of New York State Thruway system

US RUBBER Electrical Wire & Cable Department

United States Rubber

COMMERCIAL COOKING demonstrations such as this one in Maysville, Ky., helped sell 625 units and added 2,537 kw

FORTY PEOPLE attended this Rotary Club commercial cooking demonstration in Maysville. Photo shows half the group

How to Win a Hughes Award

Sale of 625 units and more than 2,500 kw additional load in a year mean $76,968 more to the estimated annual revenue of Kentucky Utilities Co.

R. W. WILSON, Manager, Commercial Business Promotion, Kentucky Utilities Co, Lexington, Ky.

Selling commercial electric cooking in the Kentucky Utilities Co territory should be tough. There are two strikes against it: 1. The company covers a wide area, mostly rural and small town in nature; 2. Gas of one type or another is available everywhere and at highly competitive prices.

But last year the company promoted sales of 625 pieces of commercial equipment, added 2,537 kw of cooking load to its lines, $76,968 to its revenues, and came through as winner of the 1955 George A. Hughes Award. Its formula: A close kinship with dealers and other members of the cooking trade, and aggressive, continual hammering at its market.

K.U. does not merchandise. Advertising is general in nature. Themes are built on the benefits of electric cooking but are not directed at the commercial cooking and baking market specifically.

Promotion is carried on by the commercial men in cooperation with dealers, distributors, and manufacturers agents. Commercial equipment is installed in some company offices which have public auditoriums. Several publications are used both as handout and mailing pieces.

The company's commercial staff is made up completely of all-purpose men. Quota assignments are designed to enable the men to meet them with above average performance and to exceed them with excellent performance. Two cooking activities are held each year.

Kentucky Utilities serves 21,000 sq miles in 76 counties, or over half of the 40,000 sq miles in the state. The area served includes 551 communities, only four of which have populations in the 10,000 to 50,000 bracket. Eleven have populations from 5,000 to 10,000 and remainder have less than 5,000.

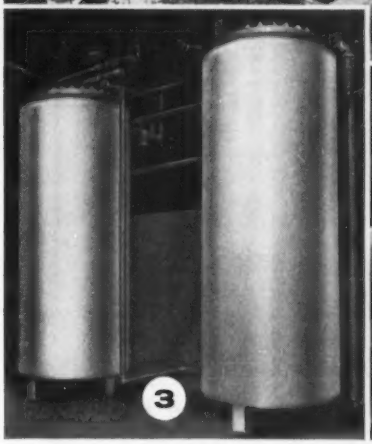
There are 25,738 commercial customers and about 1,700 food service establishments. Many are drug store counters, snack bars, roadside stands and similar operations. The number of large restaurants is small.

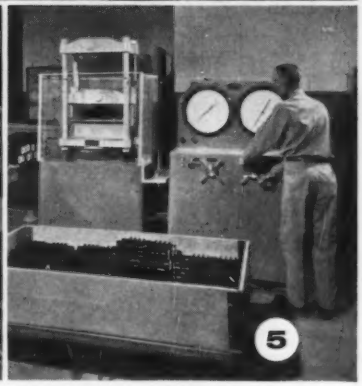
Competition is keen. Five gas transmission lines traverse the state and natural gas is available in most towns. Bottled gas in available everywhere and distributors are aggressive.

Hughes Awards Made for Commercial Promotion

The George A. Hughes Awards are aimed particularly at the development of electric cooking and water heating loads. Awards are made for promotional activities in these classes: range, water heater, and commercial cooking. Each class has two divisions—Division A for companies with 250,000 or more meters and Division B for companies having fewer than 250,000.

In each of the six categories, awards include a trophy to the company and $200 to the individual or group. Contest is open to individuals of electric companies in the U. S., its possessions, and Canada. All entries for the next contest must be sent to Edison Electric Institute before Feb. 1, 1957.

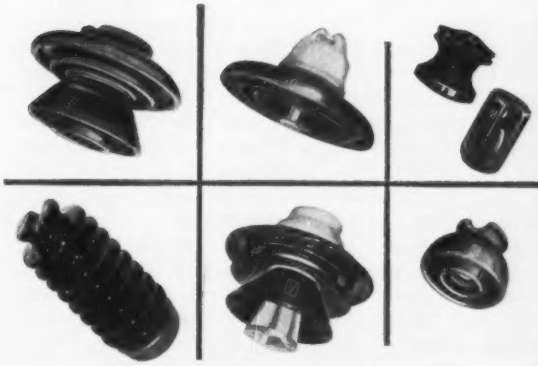




5 BIG REASONS WHY...

VICTOR GIVES YOU BETTER INSULATORS

1. Demand for VICTOR Insulators has necessitated a continual plant expansion running into many millions of dollars. In the last seven years alone, our plant area has been increased 20% to provide greater space for manufacturing, storage and research!
2. This impulse generator in VICTOR'S electrical laboratory, enables our engineers to perform steep front wave tests as well as standard impulse tests.
3. All processing water used by VICTOR is demineralized. VICTOR was the *first* in the industry to install water demineralizing equipment. A patent on our process is now pending.
4. To certify insulator soundness, VICTOR uses black light. Unfired insulators are sprayed with fluorescent material, then subjected to a near ultra-violet light source.
5. This hydraulic testing machine in VICTOR'S specialty porcelain department gives open cutouts and similar insulators a routine calculated transverse load before electrical test.



SPECIFY VICTOR

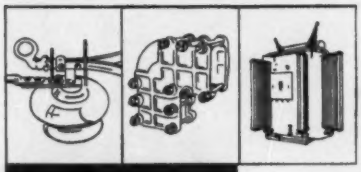
Purified Porcelain Insulators!

VICTOR INSULATORS DIVISION
I-T-E CIRCUIT BREAKER CO.
VICTOR, N. Y.

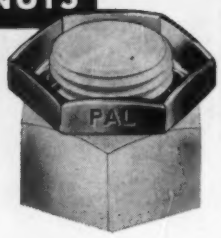
Low and High Voltage Pintypes • Suspensions • Guy Strains
Spools • Switch and Bus Insulators • Custom Designed Porcelain
Insulator Hardware

"BETTER INSULATORS THROUGH RESEARCH"

Keep Nuts Tight
on all bolted assemblies



Apply
PALNUT
LOCK NUTS



PALNUT Lock Nuts apply so fast, lock so dependably . . . you can specify them for every nut-and-bolt assembly, at negligible cost. Maintenance is reduced on mechanical assemblies — full conductivity assured on electrical connections.

PALNUT Lock Nuts may be used on new or existing equipment. Easily removed and re-used when servicing. Require only 3 bolt threads. Available in Parkerized and hot dip galvanized steel; also silicon bronze.

Send for free samples and Bulletin #577

THE PALNUT COMPANY
51 Glen Road, Mountainside, N. J.

PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost

New Lighting, Heating, Wall Treatment are RX as . . .

Doctor's Office Ills Are Cured

Doctor and patients all doing well since attractive redecoration of office provides better lighting and hides unsightly fixtures.

WILLIAM P. ACKENDORF, Power Sales Representative, Niagara Mohawk Power Corp, Buffalo, N. Y.

Two handicaps in his basement office in Buffalo, helped Dr. Emil Sternberg to decide on remodeling:

1. A single, unlouvered fluorescent luminaire with two lamps was not only sub-standard for seeing tasks but its color quality also made the doctor's patients—and the doctor—look sick.

2. An unsightly radiator mounted horizontally about 6 in. below the ceiling provided scant heat, and exposed piping proved unattractive.

These drawbacks formed the background for a remodeling prescription in which modern lighting and electric heating provided the cure. A broad expanse of wall with light, scenic background also brightened the surroundings with a picture window facsimile.

In accordance with IES Standards, a new lighting system was designed to give a maintained illumination level of 30 ft-c. Four recessed, louvered coffers with 150-w silvered bowl lamps, installed on 4 x 5-ft centers, give good quality light with complexion-flattering rendition. By lowering the ceiling 4 ft from one wall a cavity was formed to integrate a 3 x 12¾-ft section of luminous ceiling, which integrates with the decor, and conceals the piping. Light source for this consists of two continuous rows of rapid-start fluorescents on 1½-ft centers (four 40 w and one 20 w) supplied by high-power-factor ballasts.

Two 700-w recessed baseboard heating units furnish ample warmth. They have self-contained thermostats and provide a system that is clean, convenient and economical.

(*S & S shorts on page* 145)

Westinghouse equipment that helps balance cost of voltage regulation with quality of service

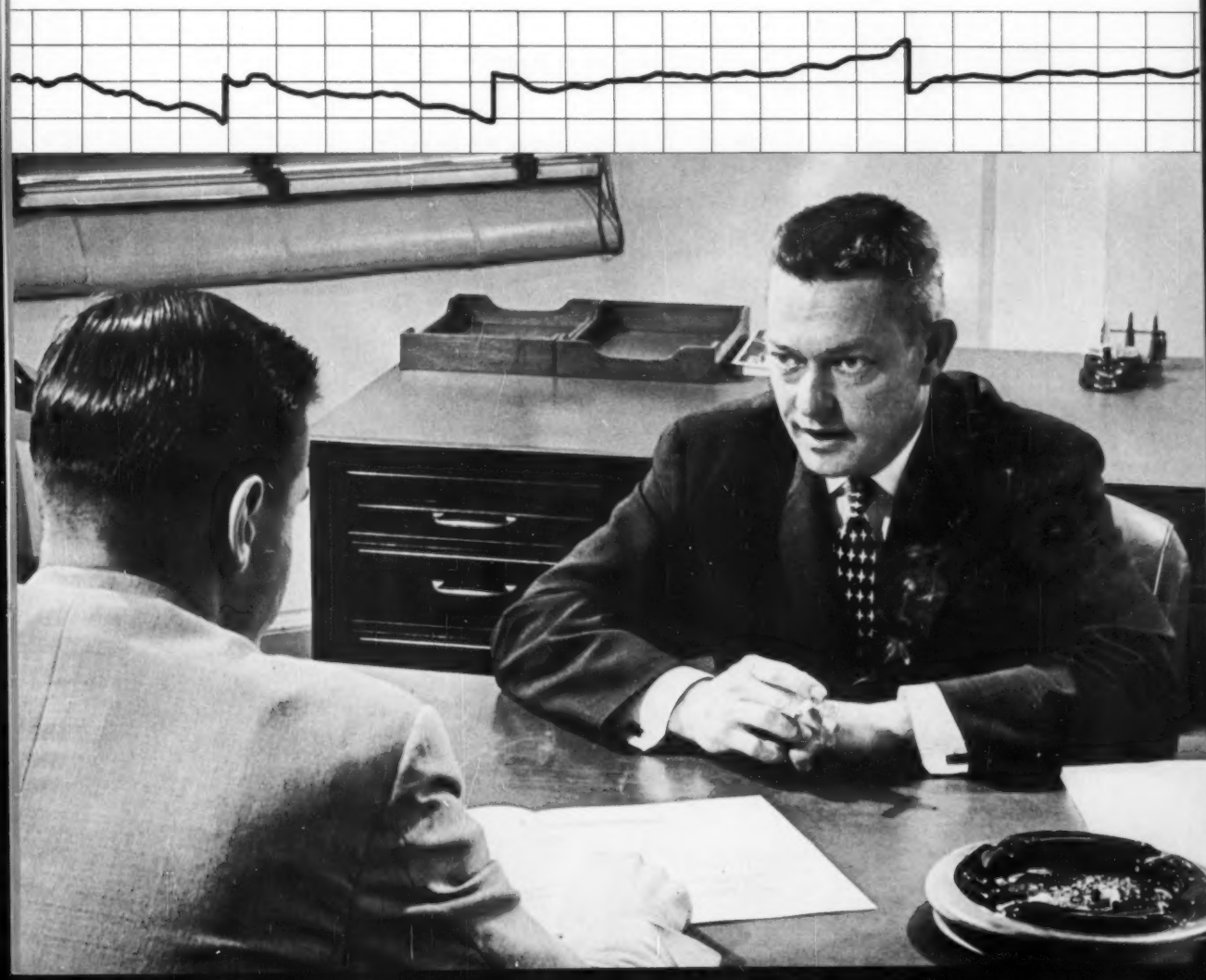
Mr. J. K. Dillard, Manager, Electric Utility Engineering, discusses System Voltage Control:

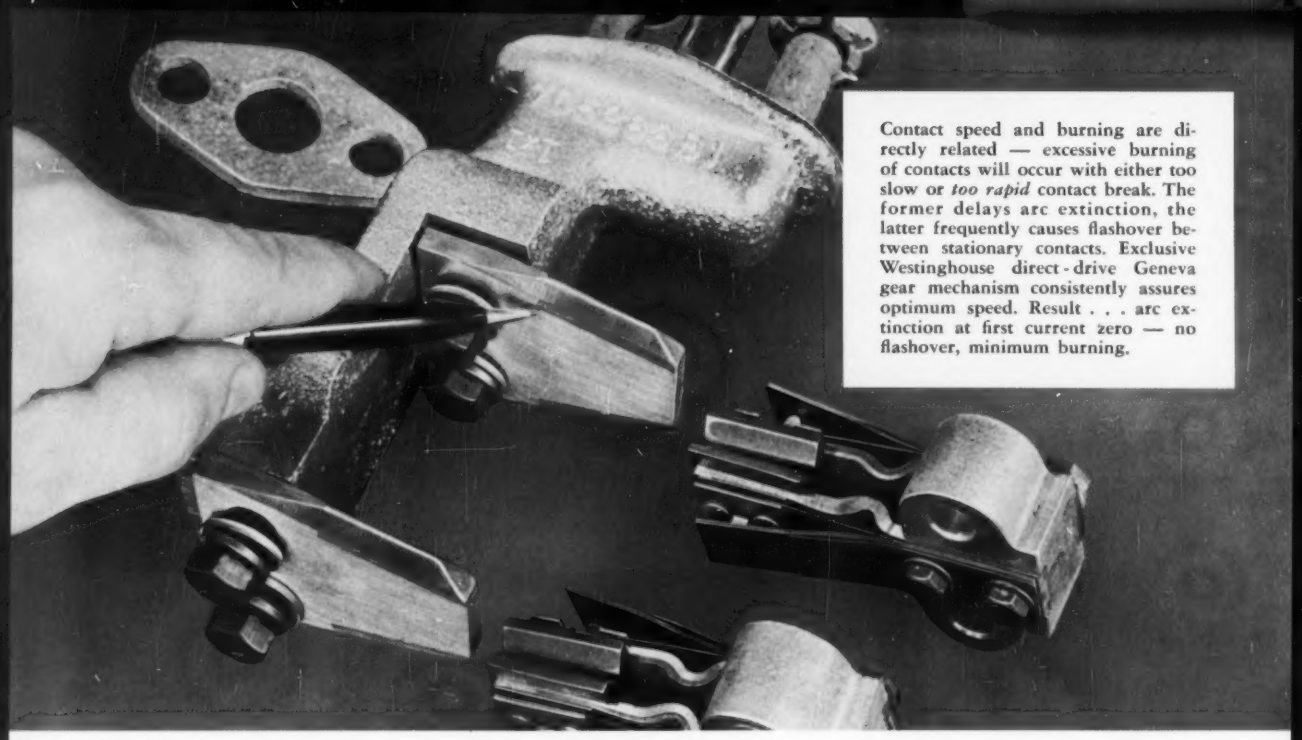
"The Utility Power System is cost sensitive to voltage regulation, a vital factor in quality of service. Westinghouse engineers are continually at work on new ideas and equipment to help solve your voltage regulation problems.

"The following pages show the broad selection of Westinghouse products that make it possible for you to achieve new degrees of voltage control."

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU**!*





Contact speed and burning are directly related — excessive burning of contacts will occur with either too slow or *too rapid* contact break. The former delays arc extinction, the latter frequently causes flashover between stationary contacts. Exclusive Westinghouse direct-drive Geneva gear mechanism consistently assures optimum speed. Result . . . arc extinction at first current zero — no flashover, minimum burning.

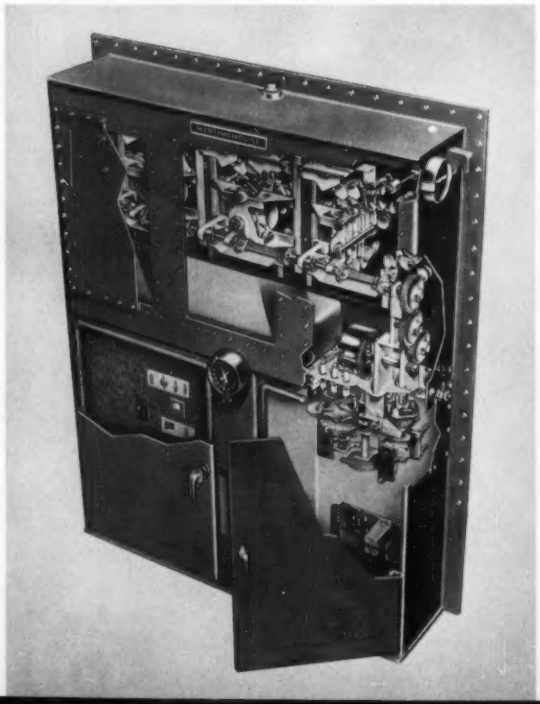
Westinghouse announces 20-year contact life warranty

For URS tap-changing mechanism . . . regardless of number of operations

Field inspections of scores of URS tap-changing mechanisms, in service 8 years or more, show negligible contact wear and burning. Based on this proved performance, Westinghouse now offers a 20-year prorated warranty on contact life — *regardless of number of operations!*

Load tap changers are direct drive; Geneva gear action assures optimum speed of moving contacts to prevent burning. This consistently controlled action is not possible with other types of drives. Geneva gear operation further provides shockless acceleration and deceleration . . . tested to 8 million operations with no appreciable wear.

Result . . . highly accurate regulation, a minimum of operating headaches.



Cutaway of URS operating mechanism reveals industry's only direct-drive load tap changing — positive, consistent, reliable action — backbone of new 20-year prorated life warranty.

New concept in precise voltage regulation

MAGAMP CONTROL

for URS and URT step regulators

Remarkable new MAGAMP* (magnetic amplifier) now standard for URS and URT load tap-changing equipment for both station step regulators and power transformers. MAGAMP sets a new mark in economy of operation. A static, completely sealed sensing device in the Type MS voltage-regulating control, MAGAMP has no moving parts, no need for mechanical adjustments, no maintenance. All settings — band width, balance voltage, line-drop compensation — are made electrically.

The principle of MAGAMP also serves the T.M. time-delay control. One setting integrates time delay for both "raise" and "lower", adjustable in a 5 to 90-second range. Resetting is automatic. In this completely static timing circuit, there is nothing to maintain, nothing to wear out. Relays actuated by this time-delay control have a proved life of more than 25 million operations.

Maintenance-free MAGAMP and unmatched *Geneva gear tap changing* — two of the soundest reasons there are for making this outstanding equipment your next investment in voltage regulation.

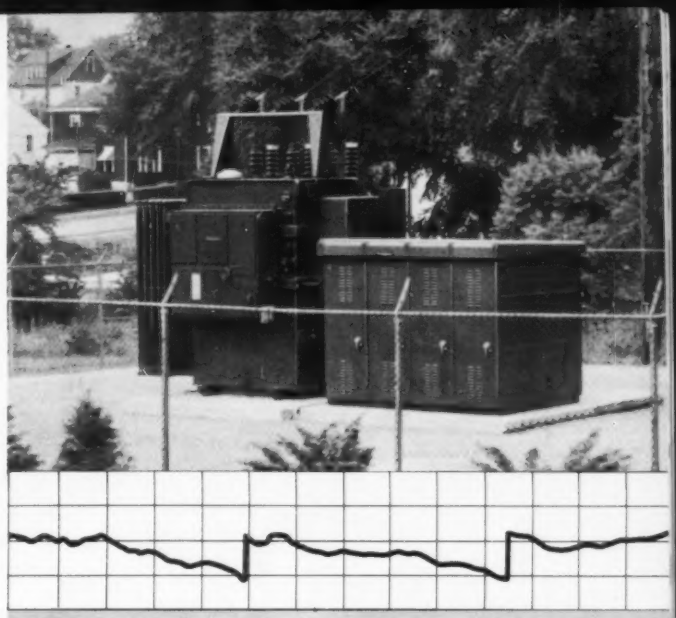
*Trade-Mark

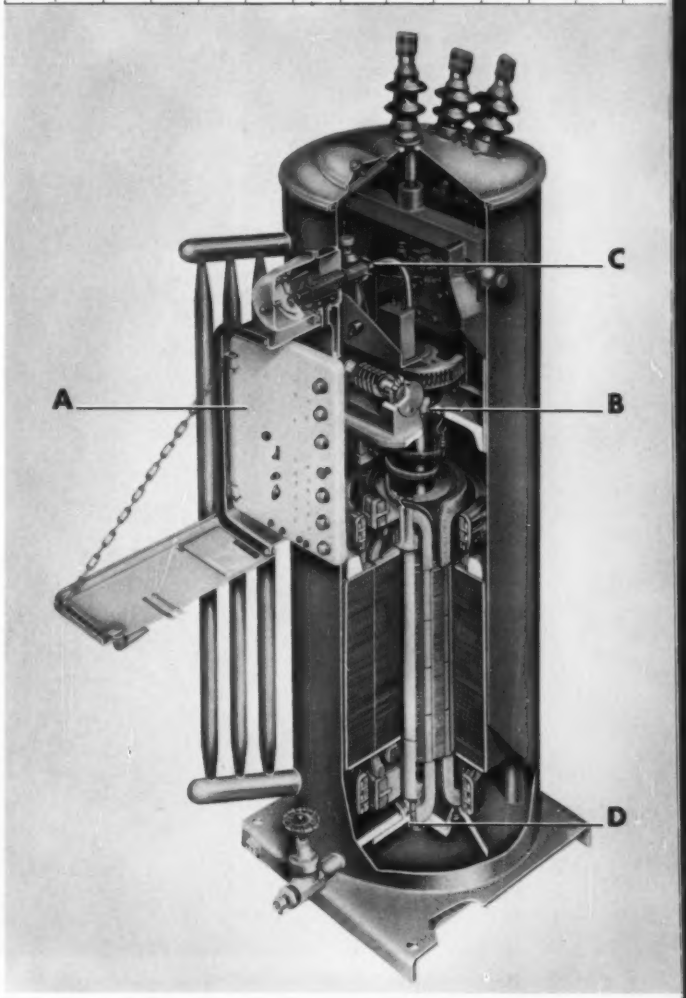
SU INDUCTION REGULATOR

with new 100% compounding MAGAMP gives you *set-it-forget-it* regulation

Two new and exclusive features make the Westinghouse SU regulator a more-than-ever reliable, precise, yet economical voltage control. First, MAGAMP for voltage sensing and motor operation delivers instant pinpoint accuracy. Completely sealed and static, MAGAMP has no moving parts to wear, foul or, consequently, to maintain.

Second, the SU with new 100% compounding returns voltage exactly to set balance level on each correction, thus achieves the narrowest band width — plus and minus a half volt — of any regulator available. The pay-off for you: More revenue dollars through higher effective voltage level.

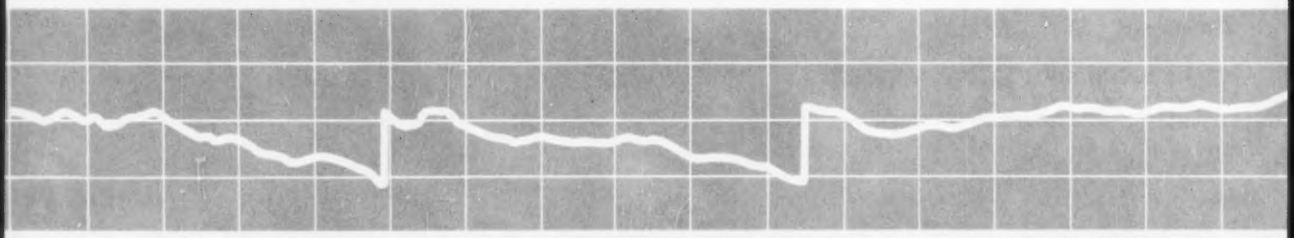


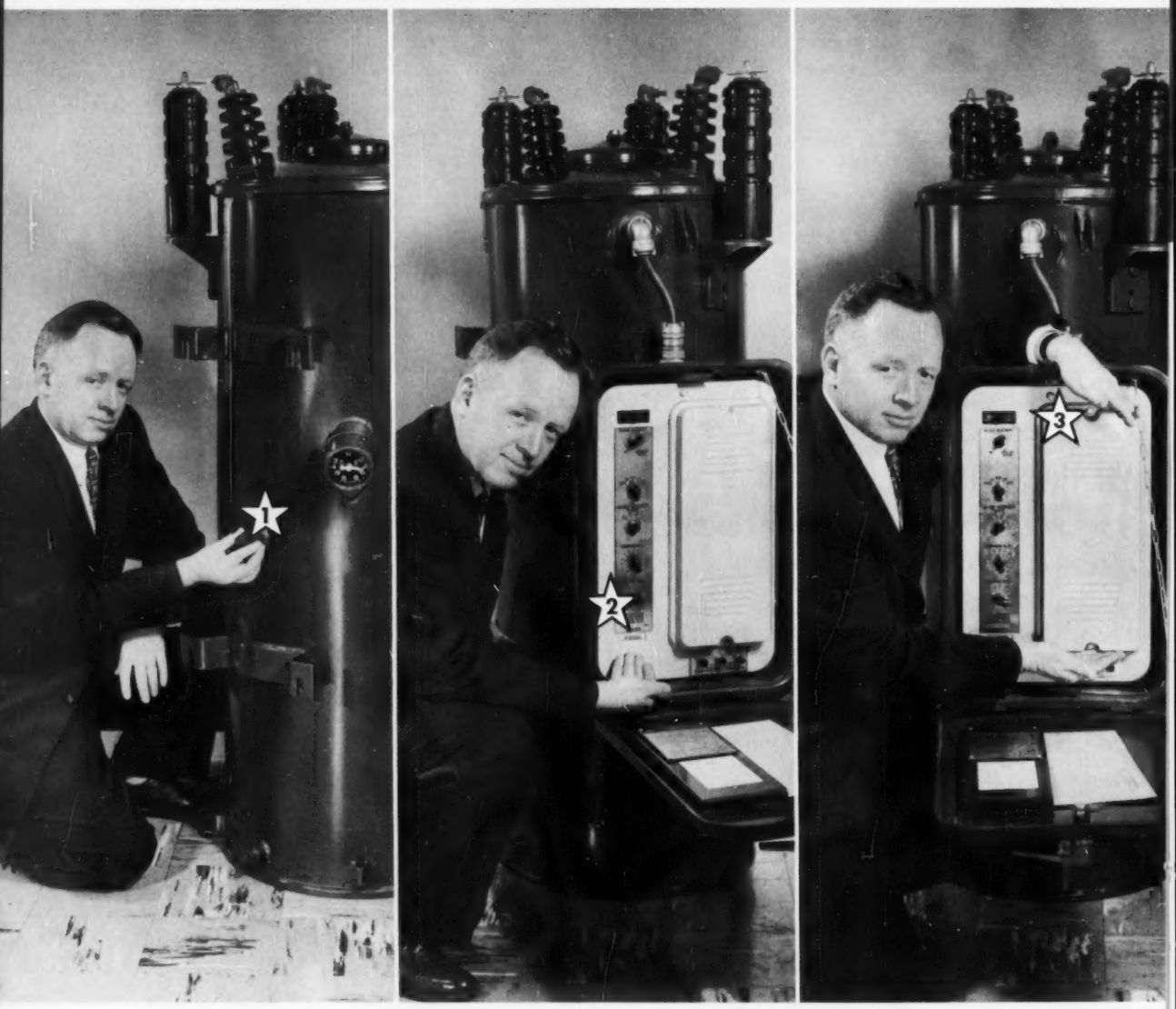


A. Maintenance-free MAGAMP control eliminates all contacts and moving parts. B. Upper bracket and worm gear housing integral castings of nodular iron assure high strength and permanent alignment. C. Swaged adapter assures permanent connection of position indicator drive. D. Permanently preloaded bearings.

WATCH WESTINGHOUSE WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!**

To improve quality of service with the new Westinghouse URL-16 step regulator . . .





Speed and versatility of the new CVR Westinghouse relay will give you the best obtainable regulation. While pickup or drop of heavy loads can be compensated for quickly — as much as 10 volts in 4 seconds — the relay can be adjusted easily to longer time delays for full range in a 10 to 90-second period for more gradual changes. Above, the URL-16 — (1) exclusive tap-changer compartment drain; (2) simplified control panel with operation counter which aids in keeping accurate operating records; (3) new CVR relay mounts quickly and easily for interchangeability with all previous URL-16 relays.

Unique CVR relay continuously monitors voltage fluctuations, corrects faster

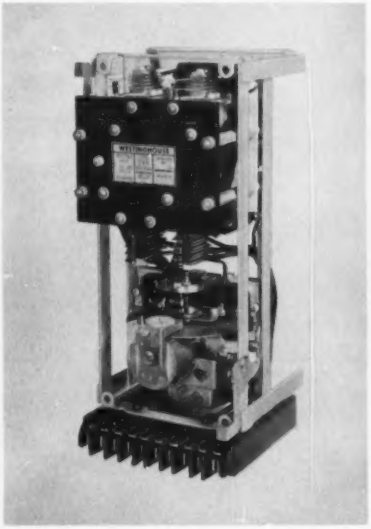
Key to the new performance standards of the URL-16 is the exclusive induction disc CVR relay which actually evaluates the need for speed of voltage correction. The CVR integrates two quantities — voltage and time. (1) It detects rate of voltage change, and (2) it responds with a speed proportional to the rate of change. Sudden or severe line drop — rapid response; slow change — slow response. The greater the need for voltage correction, the faster the relay acts to correct. This double action, combined with a new, faster tap-changer response (full buck to full boost in 13 seconds) gives you precision correction you cannot buy in any other regulator.

Another feature of Westinghouse regulators is the location of tap changer in a separate compartment. This eliminates contamination of transformer oil, fouling of core and coils, and possible flashover faults or overheating. Tap-changer oil is drained separately.

The concept of 1¼% step regulation now takes on new significance as a revenue builder. You can hold to preselected band widths faster, more closely, and more effectively improve voltage level. You get better regulation with less field servicing in the new Westinghouse URL-16.

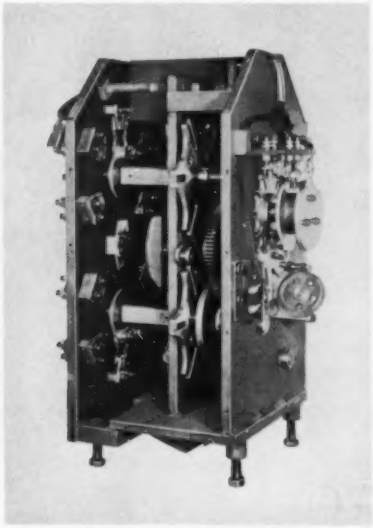
WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU**!*

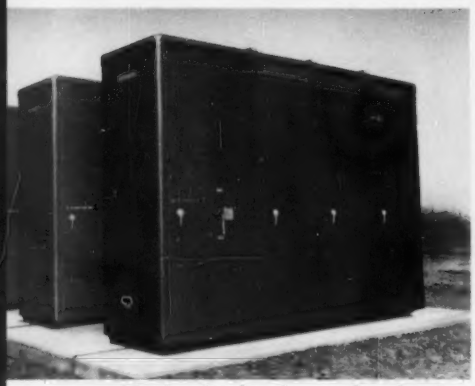


The only settings to be made on the CVR relay are the band width and time delay desired. Full interchangeability with all previous relays used in the URL-16 simplifies field service.

Unit assembly of tap changer and core-coil for greater strength and rigidity. Note separate compartment for tap changer — prevents carbon deposits from entering core and coils.

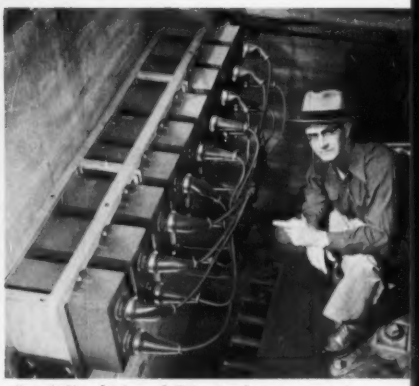


Exclusive Westinghouse direct-drive Geneva gear has no fixed time delay — operates instantly on signal from CVR relay . . . regulator can traverse full buck to full boost in 13 seconds.



Metal-enclosed equipments for substation application assure protection of apparatus and safety of personnel in congested areas.

Westinghouse Autotrol* automatically switched capacitors are factory assembled and connected, ready to install on the pole.



Specially designed Westinghouse capacitors provide quick, economical solutions to the headaches of overloaded networks.

KILOVARS . . .

You'll need one for every two kw added

Westinghouse capacitors are your most effective, low-cost source

A survey of several major power systems, made just a few months ago, estimates that one kilovar of capacitors should be added for every two additional kw of load . . . yet, already, problem areas on many systems are proving these estimates conservative. The wide range of Westinghouse capacitor designs and the broad experience of Westinghouse engineers can help you add kilovars where they will be the most effective, at lowest per-kvar cost.

Westinghouse capacitors offer real economy . . .

. . . because the basic unit in all Westinghouse capacitor equipments is not affected by climate or temperature extremes.

. . . because Westinghouse equipment is available in laborsaving, factory-assembled units for any type of installation — indoor, outdoor, pole-mounted, underground, in stacks, switched or fixed — for all applications from individual motor to large substation banks.

. . . because standardized racks and enclosures simplify installation.

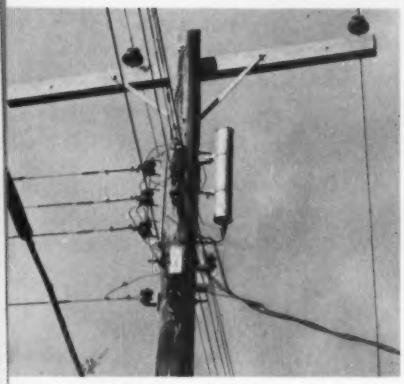
. . . and because continuous improvement in design and manufacturing techniques through a 36-year service record have kept Westinghouse ahead in capacitor development.

The exceptional breadth of experience by Westinghouse engineers in all phases of power factor correction and voltage control is the final and unequaled asset . . . always available to work with you and your consultants.

*Trade-Mark

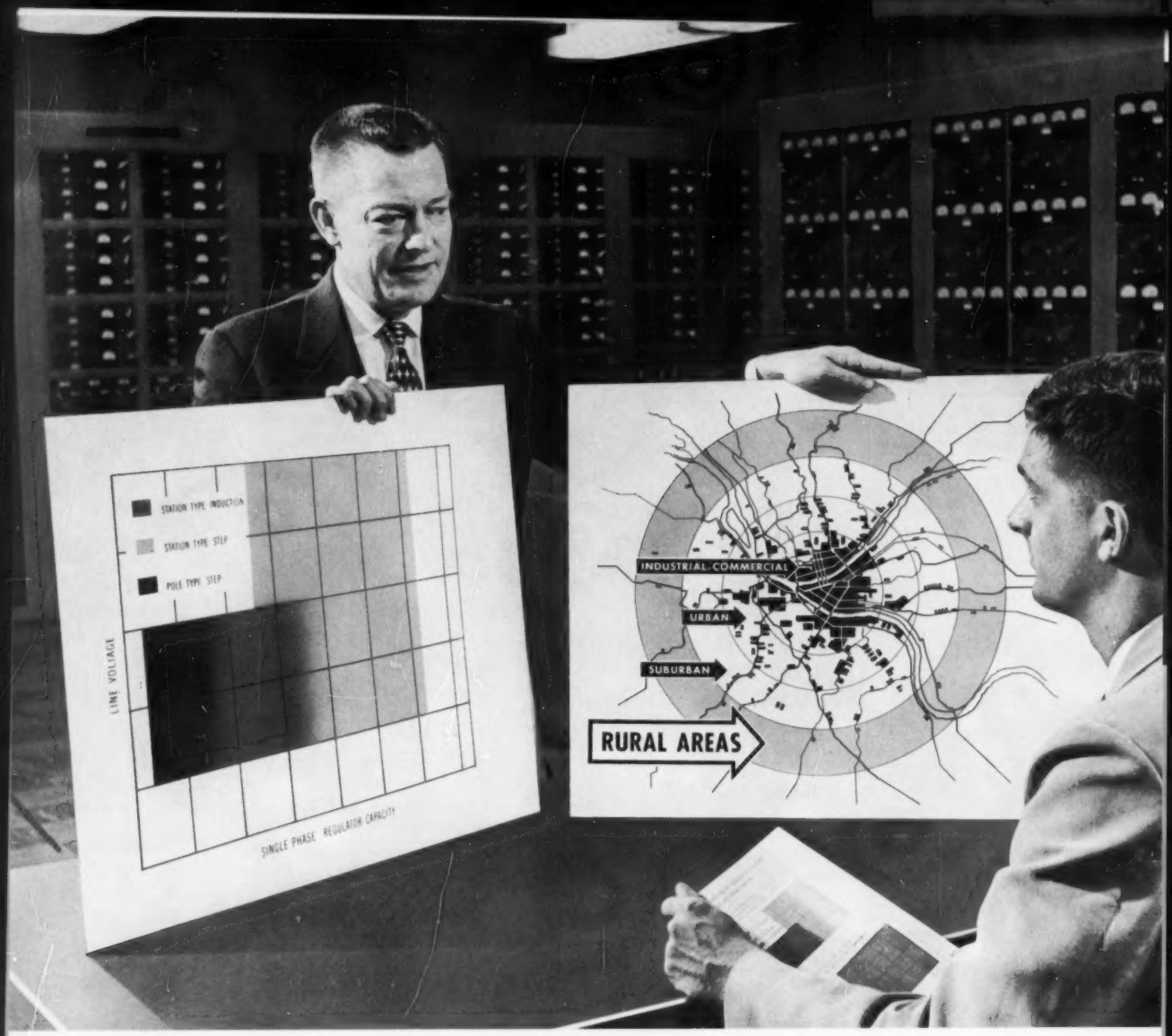
WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***



Type FPS 3, 5 and 7½-kvar distribution capacitors meet the growing needs for supplying kilovars to residential feeders.

A stack-type capacitor installation, like this, consisting of 1005 units supplies 25,125 kvar to offset exceptional I^2X losses on long, peak-load, high-voltage circuits.



More effective voltage regulation per dollar starts with

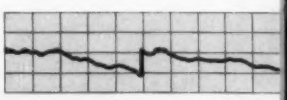
Westinghouse System Analysis and Application Engineering

The trend of modern power systems is well defined. In all directions the signs read "MORE LOAD."

Problems of maintaining proper voltage for both new and established areas are never further away than the following second . . . or the next inch on the system. The answers to proper voltage control depend upon the type of load served, its density, the location of bulk power supplies . . . in short, characteristics of your own particular power system.

In cooperation with your engineers and consultants, Westinghouse can assist with a complete or partial system analysis — the basis for sound equipment recommendations. It's just the kind of assistance that can help you achieve an economical, balanced equipment program, and consistently optimum revenue.

Call your Westinghouse sales engineer for assistance from Westinghouse electric utility engineers, the most experienced in the industry today.



WATCH WESTINGHOUSE *WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***

CP-1037

S&S SHORTS

Appliances for Employees

Two utilities have recently offered their employees plans for purchasing electric appliances. Metropolitan Edison Co of Reading, Pa., offers its people a choice of GE, Hotpoint or Westinghouse major appliances through cooperating dealers at 25% below list price. Atlantic City Electric Co, Atlantic City, N. J., offers its employees electric clothes dryers made by GE, Westinghouse, Frigidaire, Whirlpool, Hotpoint, Kenmore and others. These dryers were used in connection with the company's dryer rental plan, and can be had at no down payment and very small monthly payments.

Sunlamps—Summer in December

GE's Lamp Division describes its December-January-February sunlamp sales drive as "the most ambitious, powerful, and sustained promotion on sunlamps ever taken." The 3-month drive is designed to establish record sales during the peak buying period. "Sun Fun" is the name given to the December part of the promotion, and the January-February portion is to be known as the "Bonanza's GE Sun-lamp Blitz."

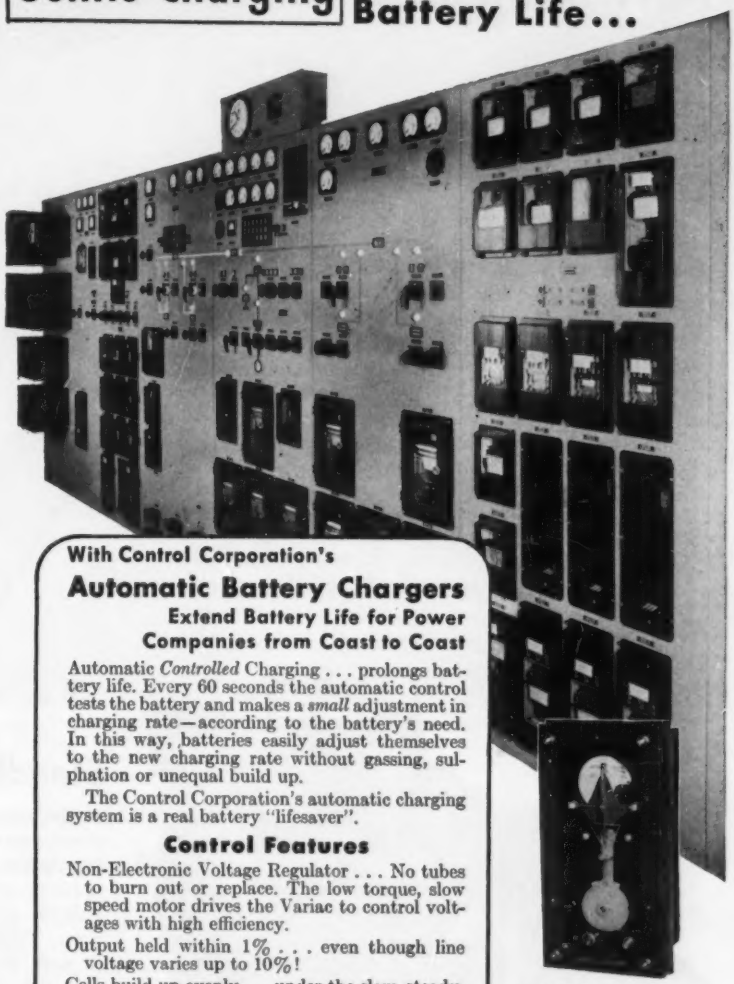
Cheyenne Goes to Mercury Lamps

Cheyenne, Wyo., which claims to be the first city to light its streets with electricity, is converting its old-style streetlights to mercury vapor. The city has signed a 10-year contract with Cheyenne Light Fuel & Power Co for installation and operation of 163 mercury vapor lamps—114 20,000-lumen lamps and 49 of the 15,000-lumen type.

A & S Buys Electronic Range

The purchase of an RCA Whirlpool electronic range by Abraham & Straus, New York, is believed to be the first by a department store for commercial use. "The store plans to use the range in its food shop for carry-out orders. "The high-speed cooking principle employed by the electronic range will permit the customer to select a cut of meat that will be cooked to her order while she waits," said David Oreck, vice president, Bruno, New York, local distributors for RCA Whirlpool appliances.

Gentle Charging for LONGER Battery Life...



With Control Corporation's

Automatic Battery Chargers

Extend Battery Life for Power Companies from Coast to Coast

Automatic *Controlled* Charging . . . prolongs battery life. Every 60 seconds the automatic control tests the battery and makes a *small* adjustment in charging rate—according to the battery's need. In this way, batteries easily adjust themselves to the new charging rate without gassing, sulphation or unequal build up.

The Control Corporation's automatic charging system is a real battery "lifesaver".

Control Features

Non-Electronic Voltage Regulator . . . No tubes to burn out or replace. The low torque, slow speed motor drives the Variac to control voltages with high efficiency.

Output held within 1% . . . even though line voltage varies up to 10%!

Cells build up evenly . . . under the slow, steady, controlled charging rate.

Lifetime Selenium Rectifiers . . . chosen for their exceptional dependability and long life. Rectifiers are convection cooled and protected thermostatically for utmost dependability.

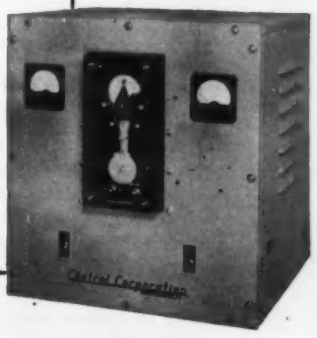
Top Quality Components . . . each one chosen for its proven service, long life and dependability.

Three Way Protection:

- Overcurrent protection . . . with air type circuit breakers.
- Thermostatic protection . . . another plus safety feature to assure controlled output under abnormal load conditions.
- 1500 volt Hi-Pot . . . gives complete protection and excellent isolation.

Behind the scenes...

The heart of the Control Corporation's Automatic Charger which selects the best charging rate every 60 seconds . . . it's a real battery lifesaver!



CONTROL CORPORATION
719 Central Ave., N. E. Minneapolis 14, Minn.

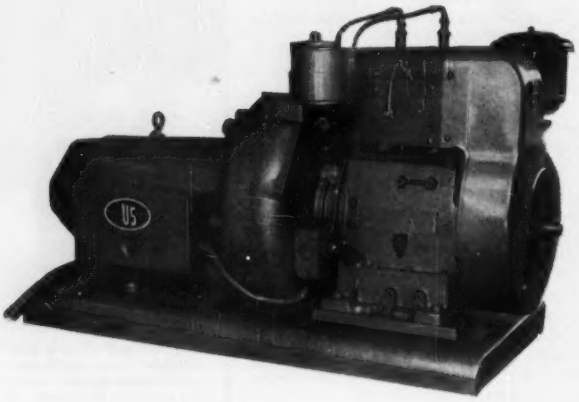
Control Corporation
The nameplate of Quality MINNEAPOLIS

• Super-Trol • Peak-Trol • Telemetering • Battery Chargers • Carrier Current

Pipe Cable Pothead

This three-conductor type pothead is designed for use with oil or gas-filled pipe cable generator terminations. Designated type ATA, it is rated at 34.5 kv and is one 1,500 Mcm cable per phase. It can be used with cables up to one 2,500 Mcm per phase or with two 1,500 Mcm cables per phase when rated at 26 kv. Pipe size is 6 in. ID (brazed or "Victaulic" couplings). A design feature is the spreader-head body made of welded non-magnetic stainless steel. No castings are reportedly used in contact with the high pressure gas or oil in the cables.

G. & W Electric Specialty Co
7780 Dante Ave, Chicago 19, Ill.



Standby Power Source

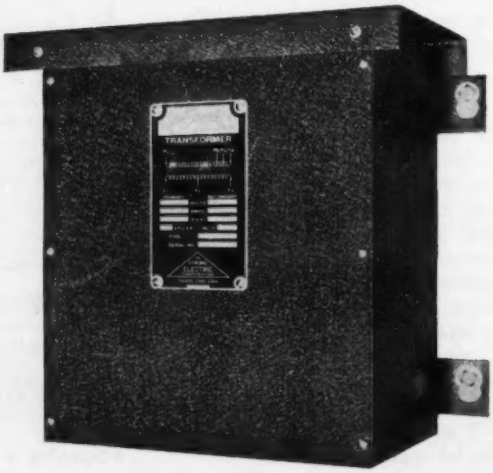
The most interesting feature of this emergency power source is the heavy flywheel between its gasoline engine and the motor-generator section. In ordinary operation, the ac motor, using commercial voltage, drives the flywheel and generator. When power fails, the momentum of the flywheel serves to start the engine and smoothly power the 5-kw, 1-ph alternator until the engine can drive it.

American Machine & Foundry Co,
New York 16, N. Y.

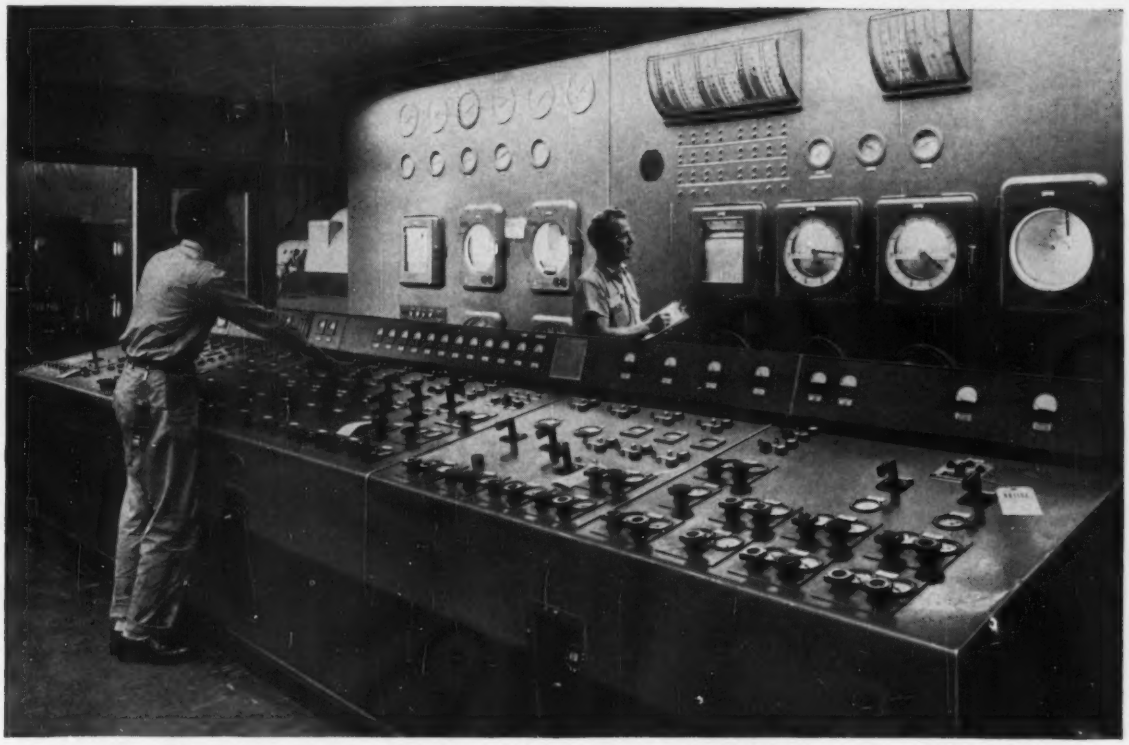
Distribution Transformers

A line of dry-type distribution transformers are said to be suitable for indoor or sheltered outdoor installations having high ambient temperatures and/or high humidity. Class H insulation, including glass-covered magnet wire, fibreglas core washers, and silicone varnish impregnation are used. Available in ratings of 2, 3, 5, and 7 kva. Case size is 16 x 12¾ x 9 in., and is said to provide proper cooling as well as plenty of room for making connections easily.

Strong Electric Corp, Toledo, Ohio



(*More New Equipment on page* 150)



Automation brings a clean, uncluttered look to Detroit Edison's main control room in the River Rouge Plant. Behind the panels—800,000 feet of control cable are jacketed with durable neoprene synthetic rubber.

Detroit Edison standardizes on NEOPRENE-jacketed control cable at new River Rouge Power Plant

Workman checks maze of circuits behind control panels. All cable is jacketed with Du Pont neoprene for maximum resistance to flex cracking, oil, ozone and flame.

800,000 FT. USED TO OPERATE TWO 260-Mw UNITS—WORLD'S LARGEST

Detroit Edison's new River Rouge Power Plant is one of the largest of its kind ever erected and reflects modern industrial design at its best. When the present unit #2 under construction is completed, the power capacity will be 520 Mw, generated by two single boiler, single turbine units—the world's largest—with future expansion to 840 Mw expected.

Equally outstanding is the plant's automatic control system—a "nerve center" so efficient that plant manpower requirements are appreciably reduced as compared to older manually operated plants. The "nerves"—800,000 feet of single and multi-conductor control cable—are jacketed with neoprene. Detroit Edison standardized on neoprene because of the importance of dependable operation of the automatic control system.

Neoprene meets every modern plant requirement with its resistance to flame, ozone, oil and aging. You, too, can be sure of lower maintenance costs, fewer replacements—*always* ask for neoprene-jacketed cable. It's available in a variety of voltage ratings.

NEOPRENE

The rubber made by Du Pont since 1932

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

FREE! THE NEOPRENE NOTEBOOK. Every issue contains interesting stories about products made with neoprene. Actual case histories give you the facts about neoprene's longer service life. Clip coupon to get on the mailing list. E. I. du Pont de Nemours & Co. (Inc.), Elastomers Division EW-11, Wilmington 98, Delaware.

*Name*_____ *Position*_____

*Firm*_____

*Address*_____

*City*_____ *State*_____

Saw Mill Parkway in Westchester County, New York, was the hardest hit of all thoroughfares. HAPCO Aluminum Poles were swamped with flood waters from the overflowing Saw Mill

HAPCO Aluminum Poles

When the year's worst storm hit, dashing seven inches of rain in a three day period on the Yonkers, New York area, parkways were swamped, roadbeds demolished, bridges washed out.

Lighting losses were kept to a minimum because highway planners specified HAPCO Aluminum standards and brackets. HAPCO Aluminum lighting equipment retains its original strength and beauty under the most adverse weather and atmospheric conditions. It requires no initial or maintenance painting, offers the highest resistance to rust and corrosion.

River, yet remained in service without special maintenance. Note luminaires are still in service.

Stand Firm in Heavy Flood

Since HAPCO poles are lightweight, they install faster, easier, you begin saving money as soon as you buy. There is a HAPCO pole designed for every outdoor lighting application. Complete information is presented in Catalog HAL-754. Write for your copy today.

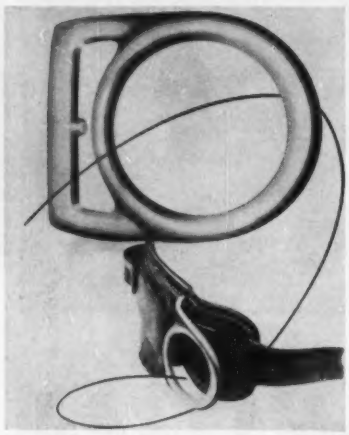
HUBBARD

ALUMINUM PRODUCTS COMPANY
Division of Hubbard and Company
Pittsburgh 1, Pa.

Light Weight Transformer

A redesign of the manufacturer's 25 kva Gardner distribution transformer has reportedly resulted in weight and height reductions of approximately 10% and an increase of 10% in core efficiency. Significant design change is the placing of eight radiator tubes on the outside of the tank; the former model had no tubes.

Federal Pacific Electric Co
Newark, N. J.



Dee Ring

Attention, Superintendents of Lines and Safety Engineers! A dee ring, designated MCD No. 1400, has been developed that is said to be adaptable to any style belt and requires no special application or different technique to use. Design reportedly makes it impossible for snap to get underneath the waist strap, thereby eliminating snap roll-out hazard. In addition to safety features, the MCD angle is more comfortable, according to the manufacturer, relieving body pressure where the dee plate is fastened to the belt because it holds the safety strap in a more normal relation to the pole.

Miller Equipment Co, Inc.
Franklin, Pa.

Service Entrance Seal

An Illinois manufacturer has introduced a unit which he says seals out moisture and absorbs vibration at the base of a service entrance mast. Called "Acme Neoprene Weather-Seal," the unit consists of a seamless base of aluminum, copper, zinc-plated steel, or lead which is adjustable to standard roof lines from flat to 45 deg. A neoprene weather seal is then slipped over the metal base, fitting snugly to keep out moisture from condensation and precipitation. Available in sizes to fit ¼, 1½, 2, and 2½-in. rigid conduit.

McCaffrey Mfg & Supply Co
1840 W. 14 Street, Chicago 8, Ill.

Pilot Plant Furnaces

A line of furnaces especially designed for pilot plant operations reportedly enables manufacturers to set up practical and controllable procedures for determining requirements for products and parts.

The line covers six units: an atmosphere box furnace 6 by 12 by 5 in. for continuous operation at 2600 F; a box furnace 5½ by 7½ by 14½ in. with reactor control; a 3-kw high frequency induction furnace; a horizontal tube furnace; a vertical tube furnace 5 in. O.D. by 8 in. effective; and a high temperature pot furnace for operation to 2500 F.

Lindberg Engineering Co
2450 W. Hubbard St, Chicago 12, Ill.

Magnetic Slip Coupling

A magnetic slip using a "cross flow ventilation" cooling system reportedly accounts for significant savings in installation space required. Designated type MDS by the manufacturer, it takes the place of his MDC and MDE lines. A single basic design is used for all sizes and ratings from 200 hp at 720 rpm to over 2,500 hp at higher speeds. Speed is changed by turning a control potentiometer, either manually or automatically. During steady-state operation, the "Regutron" is said to maintain the output within ½% of desired rotational speed.

Electric Machinery Mfg Co
Minneapolis 13, Minn.

Static Switching Controls

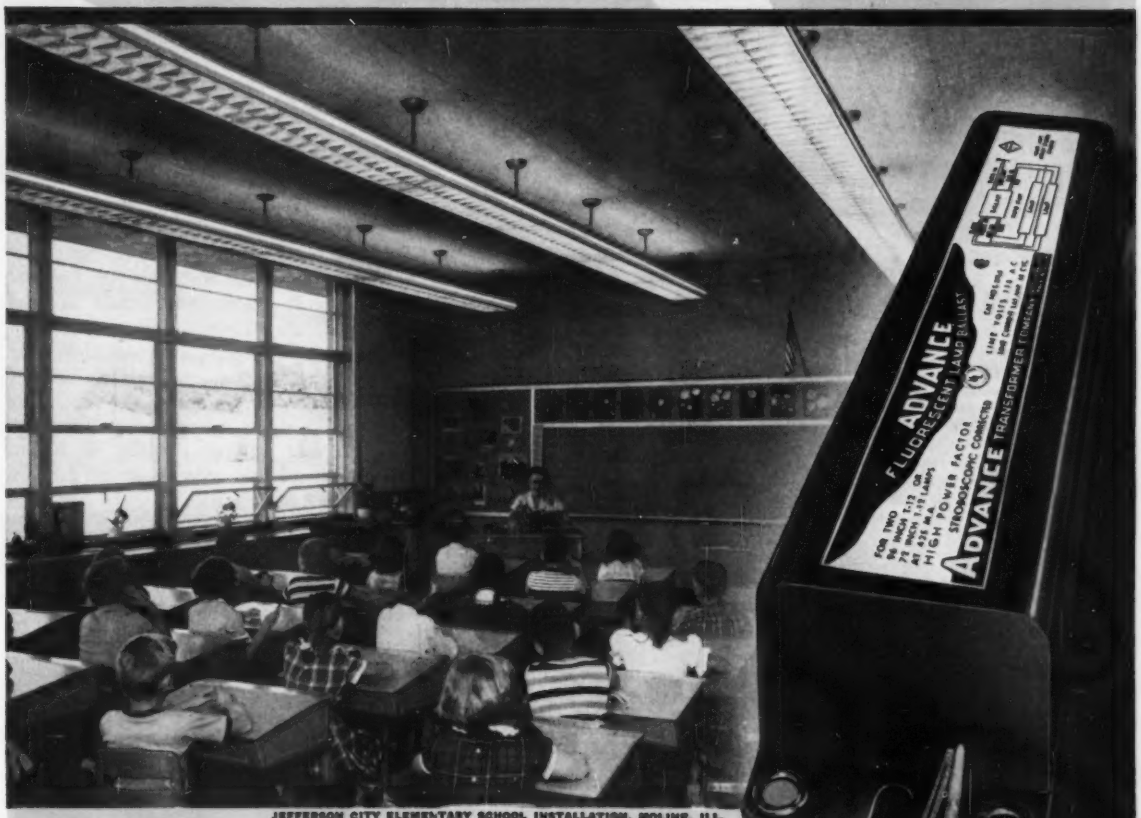
A static switching control system that reportedly accomplishes the control functions usually performed by contact-making devices, such as relays, has been developed by GE's Industry and General Purpose Control Departments. The system is designed to aid in the automation of various low-power switching operations.

Five logic functions, said to be basic to intelligence switching, are available: AND, OR, NOT, MEMORY and TIME DELAY. These logic units, and their associated components, provide a tool for better performing applications, from entire industrial processes to control of indi-

(*Continued on page* 152)

Silent Partner

To America's Finest Lighting Equipment Manufacturers



JEFFERSON CITY ELEMENTARY SCHOOL INSTALLATION, MOLINE, ILL.
LUMINAIRES BY MITCHELL LIGHTING, DIVISION OF COMPCO CORP.

A Fluorescent Lamp Ballast is used to . . . preheat lamp electrodes . . . start the lamp with a controlled high voltage and current surge . . . limit and control voltage and current at lower lamp operating levels. To efficiently perform these important functions requires a precision built, dependable Fluorescent Lamp Ballast . . . a ballast of outstanding performance to which lighting equipment manufacturers can entrust the reputation of *their* product. ADVANCE Fluorescent Lamp Ballasts have earned this trust . . . merited the title . . . "Silent Partner".

To achieve this position, ADVANCE TRANSFORMER COMPANY has developed and maintained a program of continuing research. It has built . . . a team of skilled employees utilizing modern production methods . . . a system of quality control and diligent inspection . . . and to further serve, ADVANCE has established a coast-to-coast organization of authorized service-stocking distributors. Yes, it requires all these ADVANCE facilities to completely serve America's finest lighting manufacturers.

Whether you manufacture, specify, install or maintain fluorescent lighting, investigate the fluorescent ballast line that America's leading lighting manufacturers have made their "Silent Partner".

ADVANCE

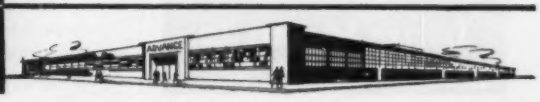
CBM CERTIFIED

World's Largest Exclusive Manufacturer of Fluorescent Lamp Ballasts

TRANSFORMER CO.

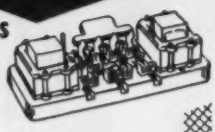
2950 NO WESTERN AVE CHICAGO 18 ILL U S A

The Heart of the Lighting Industry

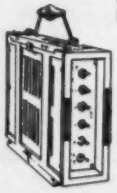


Recommended
these
METER TESTING ACCESSORIES
Now in use by Leading Utility Companies

PHASEFORMERS



ACCURATELY MEASURES REACTIVE POWER: when properly connected to a watthour meter will provide for that meter the proper potentials lagging 90° in phase from the normal circuit potentials, together with a switching arrangement whereby the meter connected thereto can be checked as a straight watthour meter.

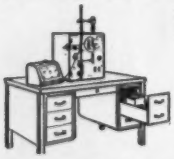


TYPE TRF RESISTANCE LOAD

The addition of a current operating fan on this item is to aid the natural draft condition and make possible a maximum capacity of 24 amperes load current at 240 volts in an aluminum case.

ROTARY TAP SWITCH

ALL INCLUSIVE FEATURES: high current capacity, non-arcing, high voltage capacity, inductive load capacity, numerous circuit combinations, special high current connections, positive action, compact design, fully enclosed.



METER TEST BOARD

So many requests have been received to provide a packaged, up-to-date, compact meter test board unit, we are presenting this equipment which has many features for efficient operation.

Write for Complete Information

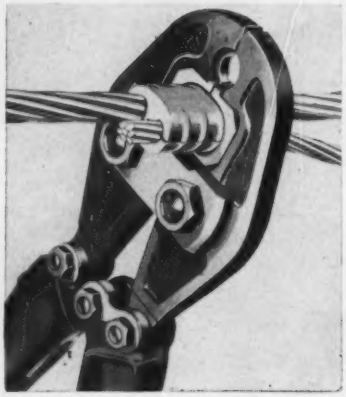
EASTERN SPECIALTY CO.
PHILADELPHIA 40, PA.

Static Switching Control

(*Continued from page* 150)

vidual machines, according to GE engineers. Available in component form or complete panels, the systems feature plug-in construction, packaged power supplies, built-in wire trough, color coding and monitor lights.

General Electric Co
Schenectady 5, N. Y.



Compression Fitting Tool

A line of compression tools for compression fittings features interchangeable insert dies that snap in and out. The lever-action tools are said to install a wide range of compression sleeves and fittings, and are reportedly safe for use on energized circuits at distribution line voltages.

Each self-aligning die half locks into its regular seat by a shoulder and a groove, and is held in place by spring-locking pins. This is said to obviate the possibility of the dies "rocking" or "canting" and gives rigidity for operation of the tools. Dies are available to install compression fittings for most wire sizes used on distribution systems.

James R. Kearney Corp
4224 Clayton Ave, St. Louis 10, Mo.

Saturable Reactors

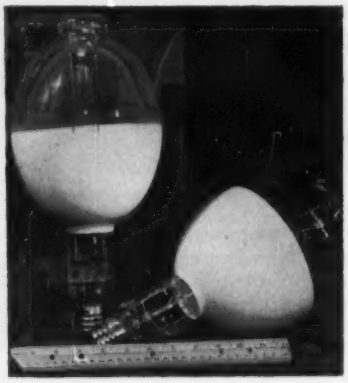
A line of saturable reactors, ranging in output from 0.3 to 500 kva, have been designed for manual or automatic control of power to load. These "transformer-type" devices are for stepless control of electrically heated equipment, reduced voltage in ac motor starting circuits, and loading reactors for test boards. The reactors come with an enclosed case with removable panels for installation and wiring or open for mounting on a control panel.

Hevi-Duty Electric Co
Milwaukee 1, Wis.

Control Centers

A line of control centers featuring space saving, accessibility, and rigidity are available in Type A, B, and C construction with NEMA 1-gasketed or NEMA 1 construction. Space occupied by the Bulletin 6200 Type W control centers is reduced because they are narrow. The space around the installation is also reduced because no access from the rear or sides is required for inspection, repair or removal of components. The basic vertical unit of the line is 20 in. wide. It can accommodate 6 NEMA size 2 starters.

Clark Controller Co
Cleveland 10, Ohio



Semi-Reflector Lamps

These two 1,000-watt semi-reflector fluorescent mercury lamps are said to have efficiency high enough to make golden-white mercury light practical in high bay industrial lighting applications where fixtures are too small to make efficient use of the fully coated lamps. Designated D-H12-WD (220 volts) and D-H15-WD (465 volts), their fluorescent half coating near the base serves the double purpose of acting as a downward reflector and a color-corrector. The coating is on the

(*Continued on page* 156)

DEAD END WITH

BLACKBURN

W6-2A from 6 Sol to 2 ACSR
This Clamp Will Handle All Popular Service Drop Wires

WEDGE CLAMPS

For Light Service
W6-4A
6 Sol to 4 ACSR

For Heavy Service
W2-OA
2 Sol to 1/0 ACSR

Conductor in contact with wedge for entire length of slider.

Removable aluminum slider allows installation without threading through clamp.

Drop wire can be pre-sagged and cut to exact length needed.

Can be attached to bare neutral at any point in the span.

Your Choice of 3 Bails

STANDARD **FLEXIBLE CAPTURED** **FLEXIBLE FREE**

JASPER
BLACKBURN
CORPORATION 35 MADISON STREET • ST. LOUIS • MAIN 1-2821

take a long look at...

meter economics

You can effect prompt and progressive savings by standardizing now on the *meter of the future* — the Westinghouse Lifetime 30-ampere, single-phase meter. With full 200-ampere extended range, it will measure all present and future single-phase residential loads that can be provided on single-phase service, and *it is guaranteed for 30 years.*

This year, 57% of the single-phase watthour meters purchased and installed by the Electric Utility Industry represented change-outs due to obsolescence in the face of growing load. The other 43% went on new homes with high initial loads and rapid growth potential.

This new 30-ampere Westinghouse meter certainly is the meter for this year — and '66 — and '76 — and even '86. First, consider the value of simplified inventory — if you standardized! Then take notice that there is *not one cent more investment,* initially, *than for modern 15-ampere ratings.* There's no mathematical trick. Call your Westinghouse sales office, or your Westinghouse meter specialist . . . or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-40493

YOU CAN BE SURE...IF IT'S

Westinghouse

We won't ask you to take a Mole's word for it, but you need to be a Mole to know what goes on below "sea" level in an anchor installation unless the anchor fails or is pulled out in a test or dug out for examination. Chance Engineers and field technicians have installed and pull tested all kinds of anchors all over the country to see what happens when heavy loads are applied. And here are the anchors they and that well known subterranean anchor expert, Mike the Mole, recommended for heavy transmission line guying.

CHANCE
CROSS PLATE ANCHORS

Install in a single, vertical machine bored hole—drilled by the same bit used for boring pole holes. It installs in only half the time required to put down a log dead man—and will actually hold a much greater load ...70,000 pounds vs. 20,000 pounds for a creosoted log. (Test data on request.)

CHANCE NEVER-CREEP ANCHORS

When hole boring equipment can be used to drill holes at an angle—Choose the Never-Creep. It holds more "over the long pull" than any other type of anchor because it holds against solid earth in an inclined hole that is relatively unaffected by moisture seepage. Order these anchors from your Chance Distributor, or write A. B. Chance Company, Centralia, Missouri.

A·B·CHANCE CO·

ABC INDUSTRIES

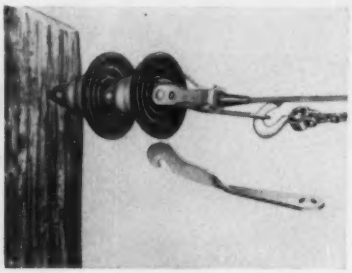
CA86-13

Semi-Reflector Lamps

(*Continued from page* 152)

inside of the lamp; this is claimed to make them suitable for use in dirty atmospheres. They are interchangeable with the manufacturer's C-H12 and C-H15 mercury lamps.

Westinghouse Electric Corp
Bloomfield, N. J.



Wire-Puller Hook

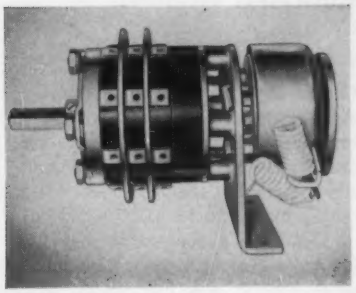
Here's a tool for use in cutting deadends and pulling slack on automatic deadends. This wire-puller hook holds the insulator and deadend assembly in line with the conductor and is said to eliminate the need for holding up the insulators with an insulator fork for inserting wire into an automatic deadend. A hook at one end of the tool hooks to the clevis bolt where the deadend clevis is attached to the insulator. At the other end a large eye for attaching blocks pulls the insulator string and deadend body in line with the conductor to be deadended. Made of cadmium-coated tool steel, it is reportedly easily applied by hand or with a "hot stick."

A. B. Chance Co, Centralia, Mo.

Rotary Multipole Switches

Rotary multiple switches, assembled with solenoid rotating devices that drive the switch through the cycle of contact positions, are said to provide remote automatic or semi-automatic control of a series of complex circuits. The switches are custom built to customer specifications.

The indexing stroke of the solenoid device is matched to the degree of rotation between contact positions of the switch, and drives the rotor one position each time the solenoid is closed. This circuit may be closed by



push button or by simple mechanical motion of the governed machine, providing the control needed for actuation.
Electro Switch Corp,
Weymouth 88, Mass.

More New Products

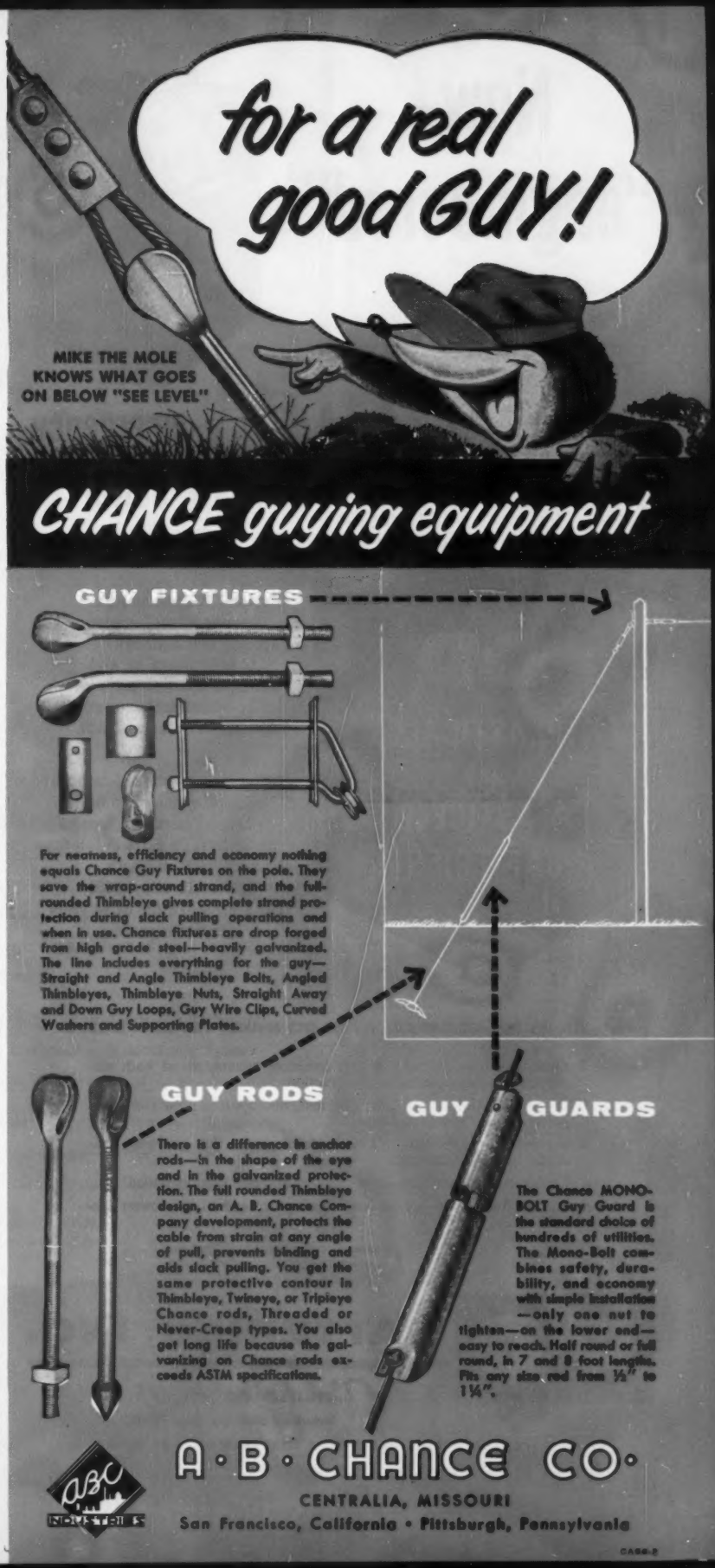
General Electric Co, Nela Park, Cleveland 12, Ohio, offers a line of **outdoor color lamps** for lighting motels, signs, displays, drive-in theaters, etc. The line, using a 150-w, PAR 38 bulb and 115-125 v, is available in red, yellow, green, blue, blue-white and pink.

Texas Instruments, Inc, 6000 Lemmon Ave, Dallas 9, Tex., have four new types of single element grown **silicon rectifiers.** They feature welded case construction and are reported to have the highest operating voltage commercially available. Forward current ratings to 125 ma.

Gulton Industries, Inc, Metuchen, N. J., has developed a subminiature high temperature **accelerometer** that measures three mutually perpendicular accelerations simultaneously. Called "Glennite" Model AHT-30T, it is said to operate accurately in temperatures from —65 to 350 F, features an acceleration range to 500 g, has a frequency response from 25 to 20,000 cps, and a sensitivity of 0.8 nv/g.

Deming Co, Salem, Ohio, has added single and duplex "Hotshot" **condensation return pumping units** to its line. The new units are rated to 10,000 sq ft of direct radiation with pressures to 20 psi. Shallow-type cast iron receivers in 6 or 20-gal sizes are said to permit low connection to the return line.

(*More New Products on page* 158)


for a real good GUY!
MIKE THE MOLE KNOWS WHAT GOES ON BELOW "SEE LEVEL"
CHANCE guying equipment
GUY FIXTURES
For neatness, efficiency and economy nothing equals Chance Guy Fixtures on the pole. They save the wrap-around strand, and the full-rounded Thimbleye gives complete strand protection during slack pulling operations and when in use. Chance fixtures are drop forged from high grade steel—heavily galvanized. The line includes everything for the guy—Straight and Angle Thimbleye Bolts, Angled Thimbleyes, Thimbleye Nuts, Straight Away and Down Guy Loops, Guy Wire Clips, Curved Washers and Supporting Plates.
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A·B·CHANCE CO·
CENTRALIA, MISSOURI
San Francisco, California • Pittsburgh, Pennsylvania
CASE-2

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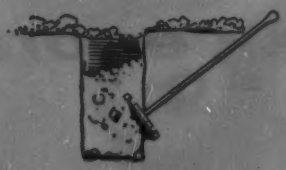

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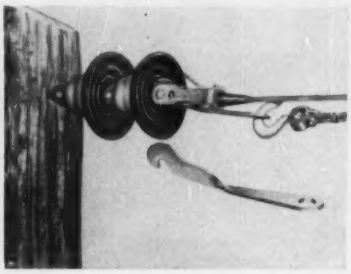

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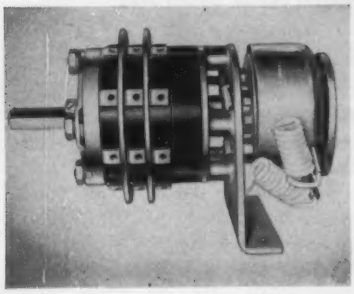

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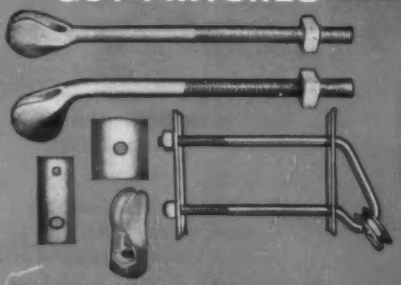
(*More New Products on page* 158)

CHANCE guying equipment

GUY FIXTURES



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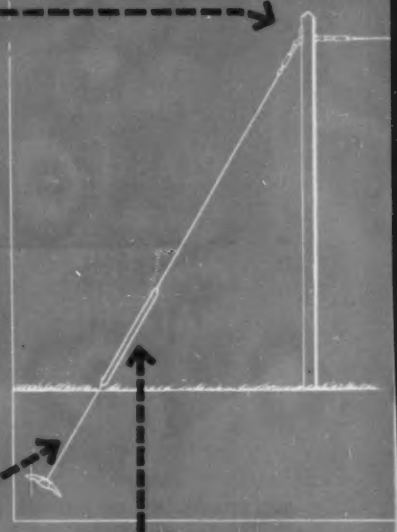
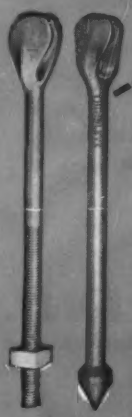


GUY RODS



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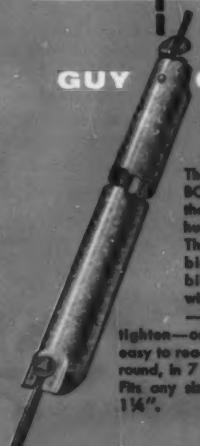
GUY GUARDS



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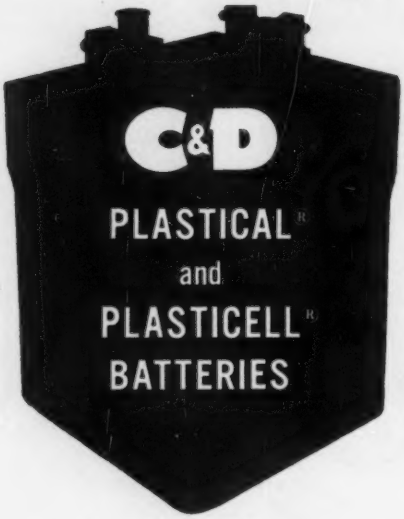
A·B·CHANCE CO·
CENTRALIA, MISSOURI
San Francisco, California • Pittsburgh, Pennsylvania

Now—"engineered" power

for switchgear-control —emergency lighting —auxiliary power



Compact, modern-design "power plants" engineered for specific applications! C & D PlastiCals and PlastiCells give you completely dependable power—*where power must not fail!*

PlastiCal—with lead-calcium grids for maximum life—is conservatively engineered for at least 25 years in full-float service. PlastiCell—with high-tensile alloy grids—has a projected life of 14 years in float service.

WITH BOTH PLASTICAL AND PLASTICELL YOU GET SUCH ADVANCED C & D DESIGN EXTRAS AS:

1. Extra-long life—exclusive design combines advantages of both suspended and supported plate construction.
2. Triple insulation—thick Fiberglas mat, microporous separators, and perforated Koroseal retainer.
3. Saftee-Vent—outstanding C & D development that prevents accidental battery explosions.
4. Crystal-clear plastic jars—heat-resistant and hermetically sealed.
5. Plastite Post Seals—for easier maintenance, and at the lowest lifetime cost.

Write for C & D Specification Bulletins:
CP-536 Rev. 1 on PlastiCal Batteries
CP-537 Rev. 1 on PlastiCell Batteries

C&D BATTERIES, INC.
of Conshohocken, Pa.
Industrial Batteries since 1906

SALES AND SERVICE OFFICES IN PRINCIPAL CITIES FROM COAST TO COAST

More New Products

(*Continued from page* 157)

Robertshaw-Fulton Controls Co, Fulton Syphon Division, Knoxville, Tenn., offers a pilot-type **thermostatic controller** for high temperature application. Designated Model 1100C, D, it is available in standard temperature ranges from 250 to 450 F, and 350 to 550 F. The controller measures 3⅛ in. wide and 19¾ in. long; it is recommended for use where compressed air is used as the pilot supply.

Sherwin-Williams Co, Cleveland 1, Ohio, offer a **modified silicone varnish** that can be air-dried or baked, is said to have high heat, chemical and moisture resistance, and reportedly will withstand operating temperatures in excess of Class B requirements.

Crouse-Hinds Co, Syracuse, N. Y., has introduced an **aluminum fluorescent fixture** for lighting tunnels, underpasses, loading docks, etc. Uses 95 watts, outdoor fluorescents, either cool or warm white.

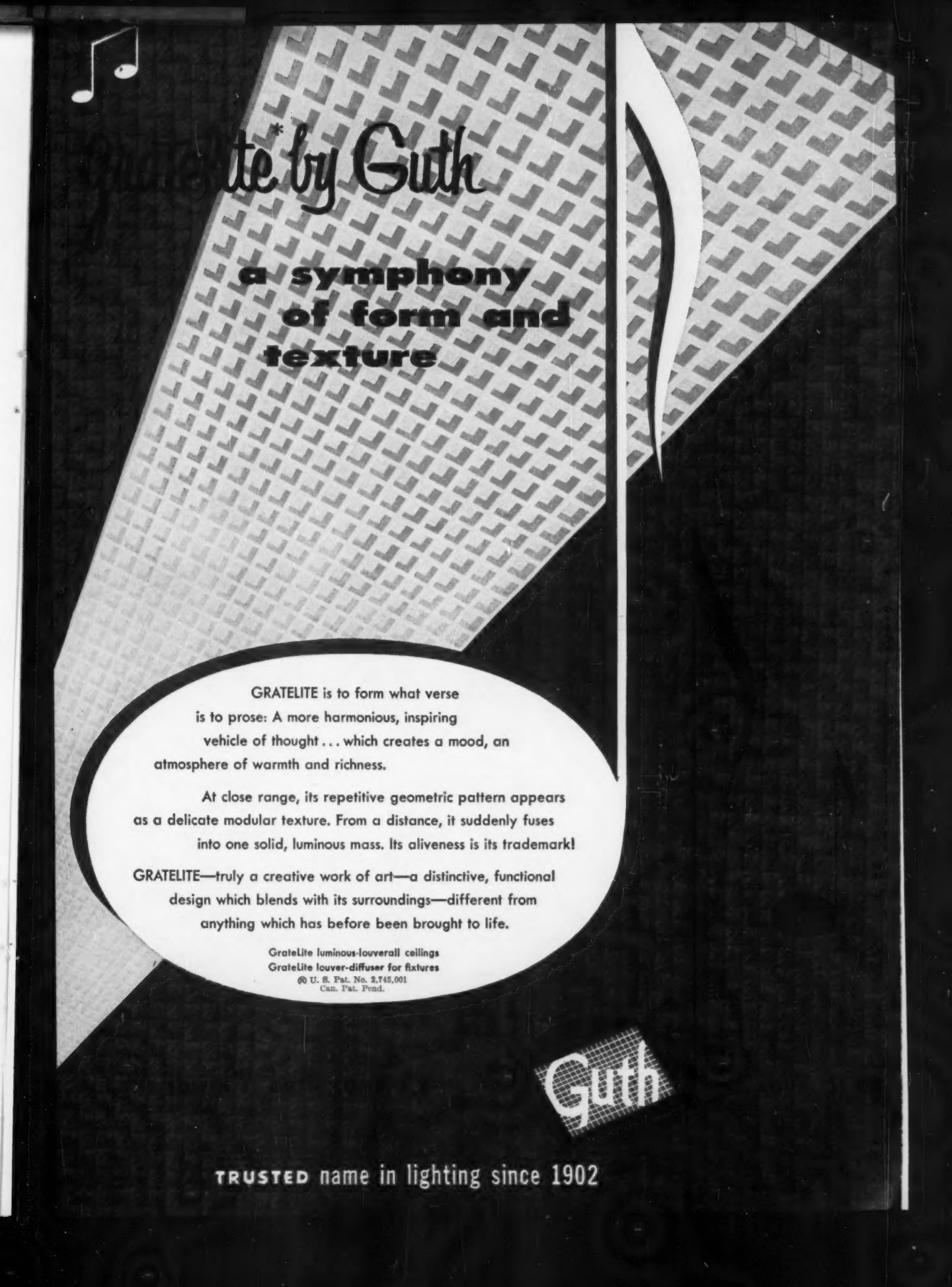
Pyle-National Co, 1336 N. Kostner Ave, Chicago 51, Ill., have a 60-cycle 3.75-25 kva **turbo-alternator** that combines turbine, generator, exciter and voltage regulator as a unit.

Gibson Electric Co, Frankstown Ave, Pittsburg 21, Pa., have developed electrical **contacts** of silver and cadmium oxide that they claim are able to withstand larger currents than do silver and its alloys, without sticking or welding.

Monsanto Chemical Co, Plastics Division, Springfield, Mass., have developed a **phenolic molding compound,** "Resinox 2200 Black," for use in heavy duty electrical control parts and wiring devices. It is said to have high arc resistance and good impact strength.

Minneapolis-Honeywell Regulator Co, Minneapolis, Minn., have a transistorized **servo amplifier and electro-hydraulic servo valve** which reportedly makes possible electro-hydraulic control of industrial machinery.

Stonco Electric Products Co, Kenilworth, N. J., have an **outdoor color lighting kit** for use with 75 and 150-w sealed beam projector lamps.


te* by Guth
a symphony of form and texture
GRATELITE is to form what verse is to prose: A more harmonious, inspiring vehicle of thought . . . which creates a mood, an atmosphere of warmth and richness.
At close range, its repetitive geometric pattern appears as a delicate modular texture. From a distance, it suddenly fuses into one solid, luminous mass. Its aliveness is its trademark!
GRATELITE—truly a creative work of art—a distinctive, functional design which blends with its surroundings—different from anything which has before been brought to life.
GrateLite luminous-louverall ceilings
GrateLite louver-diffuser for fixtures
® U. S. Pat. No. 2,745,001
Can. Pat. Pend.
Guth
TRUSTED name in lighting since 1902

Seal oil IN! Seal moisture OUT!

with

J-M TRANOLSEAL

developed especially for efficient sealing against

refined oils

You can stop the dangerous and costly leakage of oil from transformers and switchgear with Johns-Manville's Tranolseal sealing compound. This permanently plastic material has a nondrying vegetable oil base. It provides effective sealing action against air (dust and moisture), inert gas, water, 13% NaCl brine as well as medium to high viscosity refined oils. Thus you can also prevent penetration by moisture and other ambient sources of trouble.

Tranolseal has excellent adhesive qualities and will not corrode or deteriorate metals, rubber or plastics. It shows good resistance to weather and aging (both painted and natural) and won't stain. Furnished in 1" diameter beads. For further information write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit (Toronto), Ontario.

Johns-Manville
SEALING COMPOUNDS

CATALOGS—BULLETINS

• **RURAL TRANSFORMER SELECTOR:** Pennsylvania Transformer Co is offering rural transformer users a pocket-size, slide rule-type price and date selector. The pocket-size selector covers the company's line of Pole Star rural transformers, which range in size from 3 to 25 kva. Included are list prices, electrical data and mechanical dimensions for all voltage classes and for various types of transformers. No charge. Write Pennsylvania Transformer Co, Box 330, Canonsburg, Pa.

• **FRACTIONAL HP MOTORS:** A special Motor Bulletin and an Engineering Data Sheet on their "application engineered" fractional hp motors, rated from 1/300 to 1/3 hp, are available from R. A. Boehm Co, Merrick, N. Y.

• **RUBBER PARTS:** A 16-page brochure describing the rubber-parts-making facilities and operations of their Industrial Rubber Products Division has been issued by Oliver Tire & Rubber Co, Oakland 8, Calif.

• **FLUID DRIVES:** A 16-page catalog (Bulletin 9119) covering Gyrol Fluid Drives for ¼ to 25 hp applications is available from American Blower Corp, Detroit 32, Mich.

• **OPTICAL TOOLING:** An illustrated booklet explaining the theory, principles, and practice of optical tooling, a method of measuring, positioning, and aligning, is available from Charles Bruning Co, Inc, 4700 Montrose Ave, Chicago 41, Ill.

• **BOX FURNACES:** Bulletin GEC-1402 includes specifications, temperatures, ratings and dimensions of GE box-type furnaces for low production and laboratory use. General Electric Co, Schenectady 5, N. Y.

• **LENS PANELS:** An engineering bulletin, No. L-110-E, on Corning Twinlite lens panels gives product and photometric specifications for two and three lamp troffers. Write Lighting Sales Department, Corning Glass Works, Corning, N. Y. No charge.

• **COMPRESSION TOOLS:** A folder describing two of the manufacturer's hand tools for compression connectors, designated MD4 and MD5 Hytools, is available from Burndy Corp, Norwalk, Conn.

• **EQUIPMENT:** A catalog covering more than 400 items in the manufacturer's "Hi" line of electrical and mechanical equipment has been published by Holub Industries, Inc, Sycamore, Ill.

• **TRUCKS:** A 6-page brochure covering utility applications for the firm's FWD 4 and 6-wheel drive trucks has been published by Four Wheel Drive Auto Co, Clintonville, Wis.

• **TROLLEY BUS-WAY SYSTEMS:** LECTRO-FEED is the title of a booklet describing the company's lightweight, heavy duty trolley bus-way system issued by Delta-Star Division, H. K. Porter Co, Inc, Philadelphia 32, Pa.

• **RESEARCH & DEVELOPMENT:** The nature and scope of the research and development programs of AMF are described in a brochure issued by American Machine & Foundry Co, 261 Madison Ave, New York 16, N. Y.

• **"SYNDUCTION" MOTORS:** An illustrated brochure on A-C's "'Synduction" motor, gives information needed to facilitate final specifications and quotations, since all such motors are presently being engineered specially for individual applications. Allis-Chalmers Mfg Co, 932 S. 70 Street, Milwaukee, Wis. Ask for Bulletin 51B8440A.

• **HIGH FREQUENCY INSULATORS:** An Engineering Data File on "Supramica" ceramoplastics and "Mycalex" glass-bonded mica can be had from Mycalex Corp, Clifton, N. J.

• **PHOSPHOR-BRONZE:** A 4-page data sheet on ultra-thin gauge, high tolerance phosphor-bronze is available without charge from American Silver Co, 36-07 Prince Street, Flushing 54, N. Y.

• **THERMOCOUPLES:** A brochure on the manufacturer's "Kwik-Konnect" thermocouple components may be obtained from Minneapolis-Honeywell Regulator Co, Industrial Division, Philadelphia 44, Pa.

• **WEIGHING SYSTEMS:** Bulletin 561 features possible arrangements of the Emery tank and bin weighing systems. Published by A. H. Emery Co, Pine Street, New Canaan, Conn.

• **SOLDERLESS WIRING DEVICES:** An 8-page technical bulletin, "Solderless Wiring Devices," describes and furnishes sizes and specifications on the solderless terminals and connectors made by Electric Terminals Corp, 2021 Center Street, Cleveland 13, Ohio.

• **WELDING ALLOYS:** "Fight Against Fahrenheit" is the name of a 12-page booklet telling about the importance of the U. S. Patent System to its research and development of advanced metal-joining alloys and processes available from Eutectic Welding Alloys Corp, 40-40 172nd Street, Flushing 58, N. Y.

• **COMPANY STORY:** Its products and achievements are discussed in a 16-page catalog issued by Gulton Industries, Inc, Metuchen, N. J.

• **METALS:** A catalog illustrating main classifications of their products has been published by Metals & Controls Corp, General Plate Division, Attleboro, Mass.

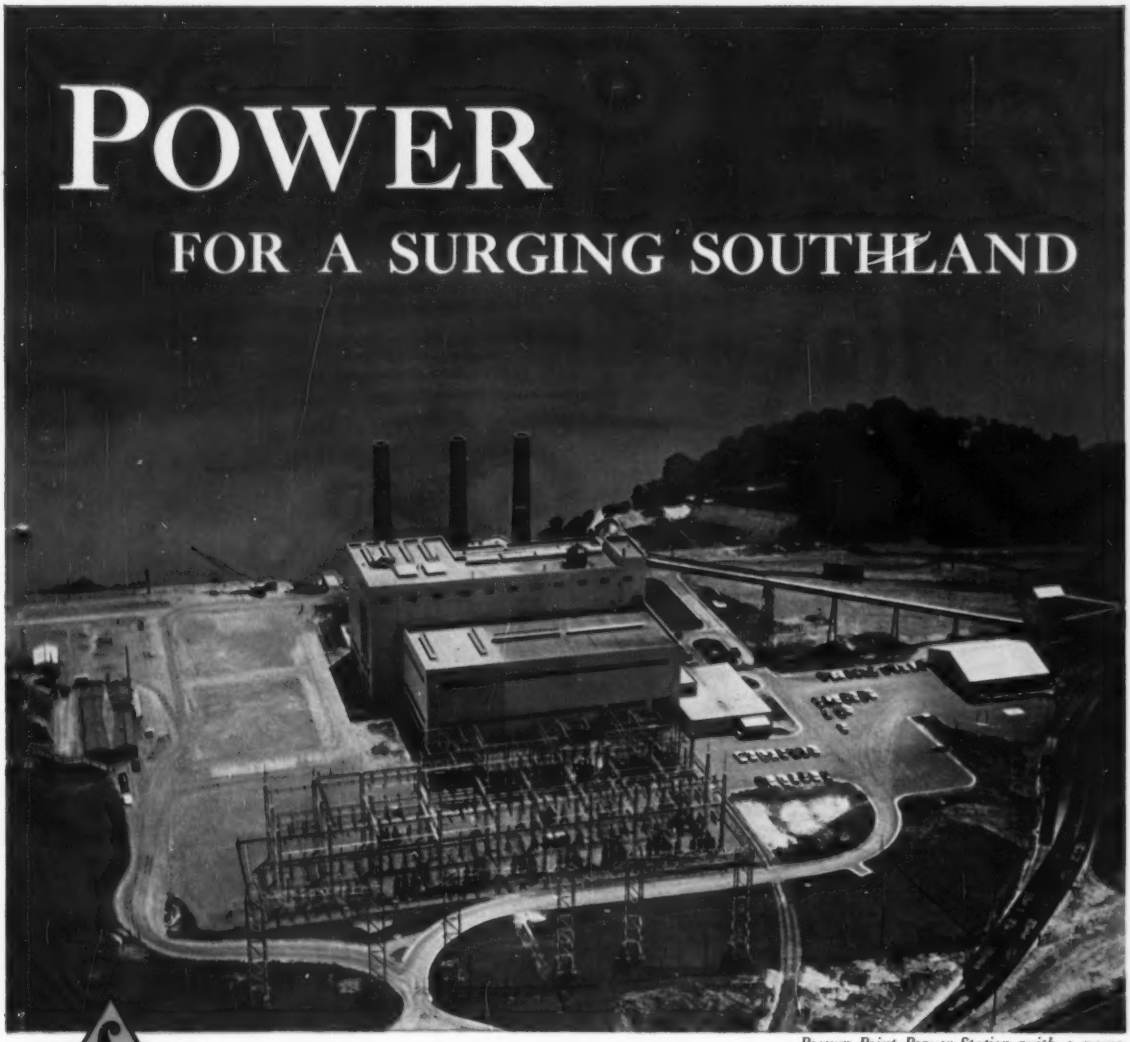
• **NUCLEAR REACTOR TYPES:** A booklet for laymen explaining the various types of reactors, how they compare and how they differ, has been published by Minneapolis-Honeywell Regulator Co, Industrial Division, Philadelphia 44, Pa. Ask for "Nuclear Reactors, a Basic Guide." No charge.

• **SWITCHES & RELAYS:** A catalog of their Jaico switches and relays has been issued by Jaidinger Mfg Co, 1921 W. Hubbard Street, Chicago 22, Ill.

• **RELIEF VALVES:** Bulletin No. 1255-B describes the line of relief valves and back pressure valves of the Milton Roy Co, 1300 E. Mermaid Street, Philadelphia 18, Pa. Write Market Development Dept.

• **WELDING:** A "selec-Tic" welding shop wall chart (TIS 2616) of 150 Eutectic "Low Temperature Welding Alloys" is available from Eutectic Welding Alloys Corp, 40-40 172 Street, Flushing 58, N. Y.

POWER
FOR A SURGING SOUTHLAND



Possum Point Power Station with a name plate capacity of 220,000 kw is located on the Potomac River near Quantico, Virginia

The third generating unit of the Possum Point Station of the Virginia Electric and Power Company – designed and built by Stone & Webster Engineering Corporation – went on the line in mid-1955, with a name plate rating of 100,000 kilowatts.

The Engineering Corporation is presently installing four 150,000 kilowatt units in three other generating stations being designed, constructed or extended for this client for commercial operation in 1957, 1958 and 1959.

These additional power facilities are examples of the forward looking steps being taken by Virginia Electric and Power Company to satisfy the rapidly expanding power requirements of the VEPCO system.

Write or call us for information as to how our experience can be of assistance to you.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY of STONE & WEBSTER, INC.

New York Boston Chicago Pittsburgh Houston Los Angeles San Francisco Seattle Toronto

New Automatic Precipitator Control by

WESTERN PRECIPITATION

offers many vital advantages...

1 LONG LIFE

This new control has indefinite life expectancy under all types of operating conditions. There are no tubes to replace, no high speed relays, counters, or timers to maintain. All circuitry consists of rugged "static" devices that have unusually long life!

2 RELIABILITY

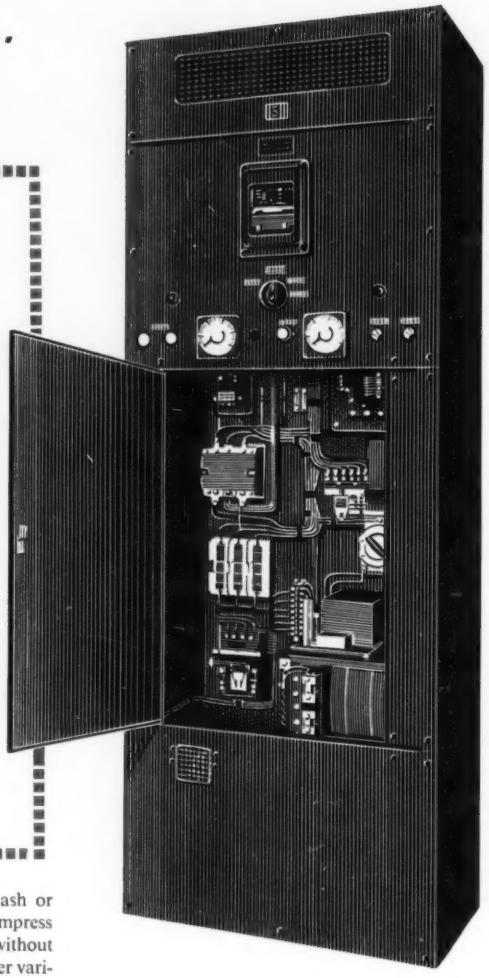
Optimum Precipitator power input is maintained regardless of operating conditions. The sensing control is simple, positive, accurate—and automatically evaluates the spark "Power Value" (intensity and frequency)—not just frequency or intensity alone.

3 STABILITY

Under short circuit, open circuit or other varying conditions, this control is completely stable and inherently trouble-free!

4 MODEST COST

Modest initial cost coupled with negligible maintenance assure optimum operating efficiency (therefore lower operating costs) throughout many years of continuous service.



WHEN using a Cottrell Precipitator for collecting dust, fume, fly ash or other suspensions from industrial gases, it is essential at all times to impress on the high voltage system the highest possible voltage and current without "flashover". Depending upon gas conditions, dust loading and other variable factors, the optimum voltage and current requirements vary widely from one minute to the next. Therefore, the vital importance of a simple, trouble-free and highly sensitive Precipitator Control is self-evident.

This new Western Precipitation Automatic Precipitator Control—*a product of the organization that has consistently led in the application of Cottrell Precipitators for industrial gas cleaning*—combines vital advantages found in no other competitive equipment. Our nearest representative will be glad to supply complete details. Or write direct!

Why not modernize your present out-dated Precipitator installation? The Western Precipitation Automatic Precipitator Control can be installed on any Cottrell unit. For further information contact our nearest office!

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Designers and Manufacturers of Equipment for Collection of Suspended Material from Gases . . and Equipment for the Process Industries

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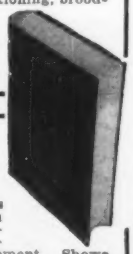
Shows the man on the farm where added electrification will be most advantageous, how to plan and install safe, adequate wiring systems, and how to choose the equipment best suited to his needs. Explains how appliances use energy and how to measure, how to plan for outlets, use controls, select motors, etc. Helps in use of electricity for pumping, refrigeration, elevators, fences, crop conditioning, brooders, and many other purposes. **By R. H. Brown, Assoc. Prof., Agri. Engg., U. of Georgia. 367 pages, 188 illus., $7.00**



ELECTRONICS IN INDUSTRY

Gives the man who uses electronics equipment in plants a thorough, nontechnical description of electronics circuits and equipment. Shows how tubes and tube-operated circuits work in motor control, welding control, and other industrial applications. Explains large number of commonly used industrial electron tube circuits. **By George M. Chute, U. of Detroit. 2nd Edit., 440 pages, 344 illus., $7.50**

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BOOKS

Received Since Nov. 12

Circuit Theory and Design. By John L. Stewart. Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y. 480 pages, illustrated. Price $9.50.

National Standards in a Modern Economy. Edited by Dickson Reck. Published by Harper & Brothers, 49 E. 33rd Street, New York 16, New York. 372 pages. Price $5.00.

How to Build Foundations

Foundations—Design and Practice. By Elwyn E. Seelye. Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y. 494 pages, illustrated. Price $16.00

This book for the beginning engineer covers design, construction methods, costs, specifications, and field practice for all phases of foundation work. It is profusely illustrated and contains an adequate glossary and a complete set of typical foundation specifications.

A utility engineer would find this book helpful if he needed to learn quickly or brush up on the do's and dont's of design and field practice for such foundation work as dams, reservoirs, embankments, plant floors, and soil mechanics. But, because of its wide scope, it does not furnish the type of detailed information that an experienced engineer would be seeking in his special field, such as dam design and construction.

Theory of Electronic Control

Electronics in Industry. By George M. Chute. Published by McGraw-Hill Book Co, Inc, 330 W 42nd St, New York 36, N. Y. 431 pages, illustrated. Price $7.50

Since the first edition appeared in 1946, this book has been expanded to include some of the more recent developments in welding control, heat and light relays, industrial control tubes, dielectric and inductive heating, and transducers. A brief outline of closed loops as they apply to automated processes is provided. The book is intended as a general survey of industrial electronics and the reader is assumed to be unfamiliar with basic electronic circuits. In brief, well coordinated steps, using a minimum of mathematics, the author presents those electronic circuits essential for an understanding of industrial practices. Some portions of the book are intended specifically for students and most chapters include problems.

The book is a valuable asset to utility engineers seeking a general background in industrial electronics. It would also be a suitable text for young technical or engineering personnel in electronic control.

ACCO Quality

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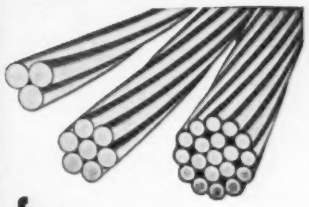

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THE WESTINGHOUSE RECLOSER LINE PRESENTS...

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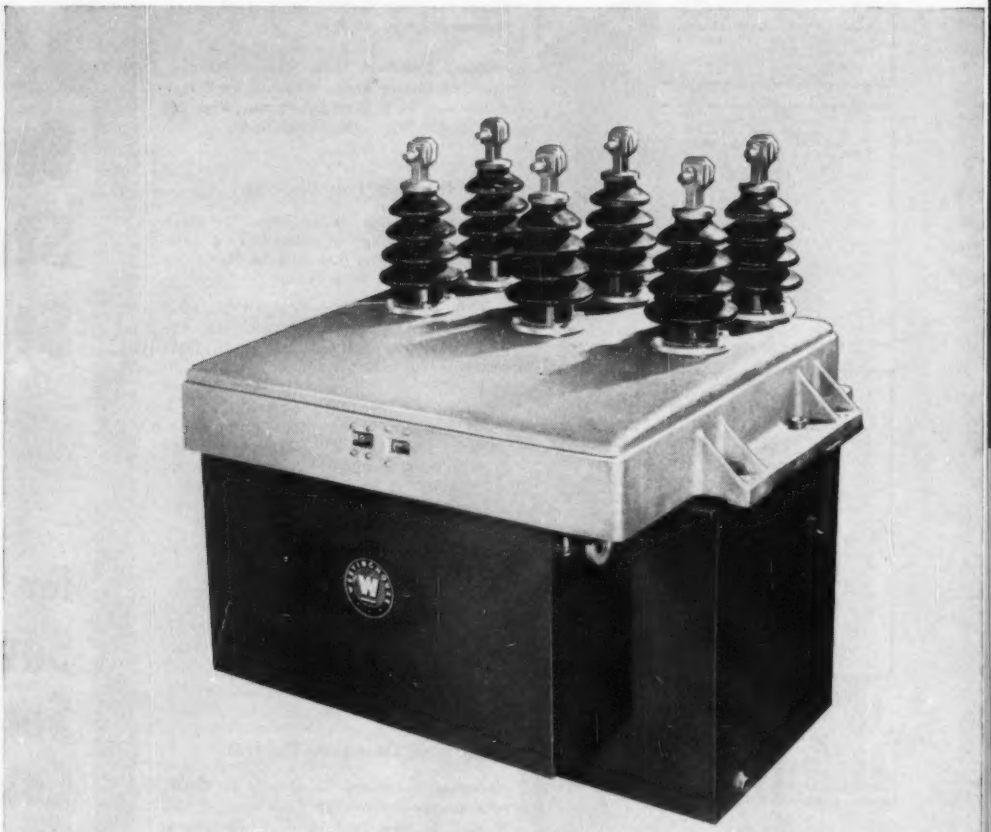
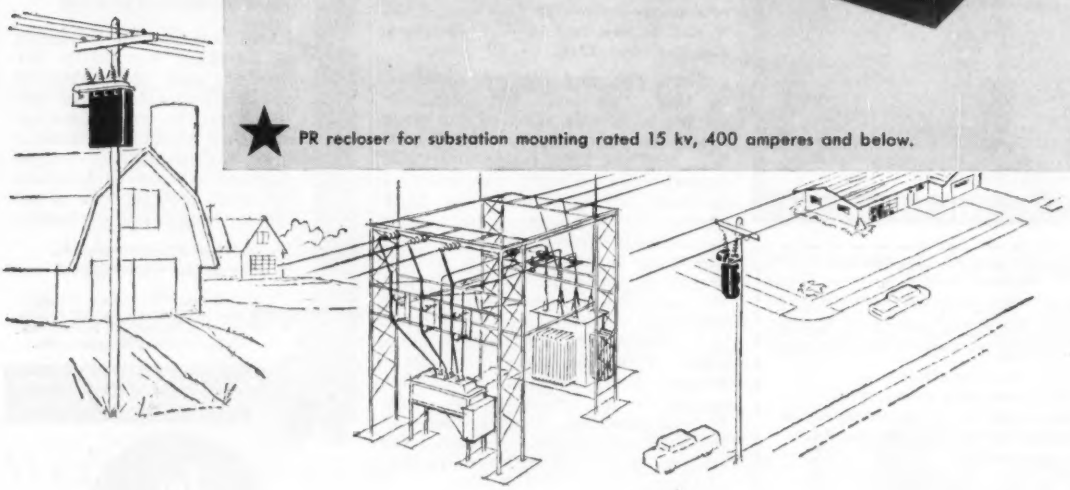
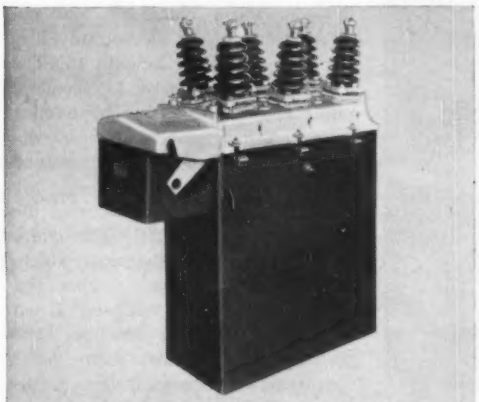


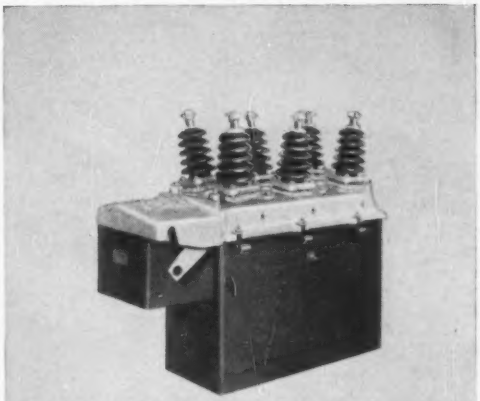
★ PR recloser for substation mounting rated 15 kv, 400 amperes and below.



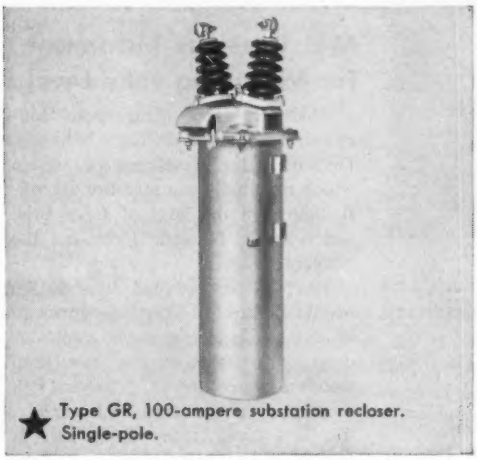
but widely imitated all★star production



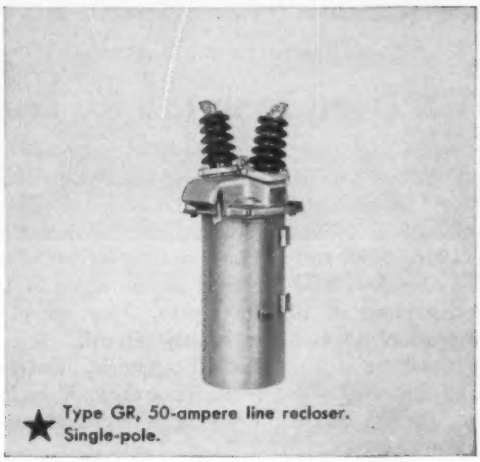
★ GR-3, 100-ampere automatic circuit recloser. Three-pole, 2,300 to 15,500 volts.



★ GR-3, 50-ampere automatic circuit recloser. Three-pole, 2,300 to 15,000 volts.



★ Type GR, 100-ampere substation recloser. Single-pole.

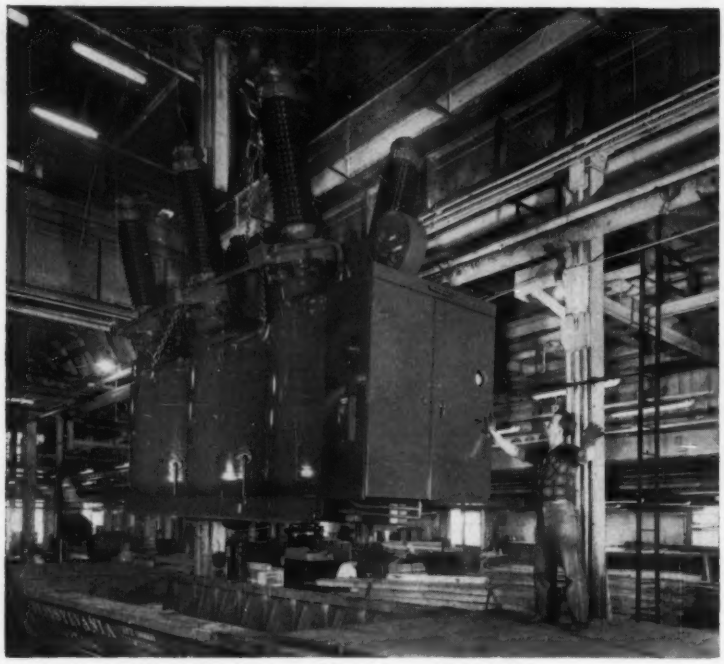


★ Type GR, 50-ampere line recloser. Single-pole.

★ Get these NEW features: ★ Big operation counter can be read from the ground—the only one that can be reset. ★ One-piece aluminum head casting gives better seal, less maintenance, longer life. ★ Manual operating handle shaft-sealed against dirt and moisture. Plus these long-time standards: ★ One-half to two-thirds as many parts. ★ Simple, reliable. ★ Exclusive De-ion® interrupter arc-quenching. ★ Single operation to lock out if manually closed on fault, not full-automatic cycle with resultant extra wear. ★ Time delay on manual close on cleared circuit rides through inrush load pickup. ★ Seamless, weldless, galvanized drawn-steel tank eliminates need for painting. ★ Integral surge and lightning protection in bushing-mounted arrester. ★ Two-to-three-cycle opening and power restoration. ★ Hydraulic timing—nine combinations of instantaneous and time-delay operation. ★ Bushings, coils and contact details interchangeable in 50- and 100-ampere series. ★ Built to the quality standards of the Westinghouse circuit breakers. ★ For complete details, ask your Westinghouse sales engineer or distributor for booklet B-4339—or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh, Pa.

J-60897

YOU CAN BE SURE... IF IT'S Westinghouse



Westinghouse Gets Ready to . . . .

Ship First Dead-Tank 138 Kv Breaker

This dead-tank high-capacity outdoor compressed-air circuit breaker is reportedly the first ever built. It was developed and manufactured by Westinghouse Electric Corp (EW, Mar. 26, p 59). This unit and 21 identical units will be delivered to Consolidated Edison Co of New York during late 1956, 1957, and 1958.

The 138-kv breakers have a normal current rating of 1,600 amp, and an interrupting rating of 10,000,000 kva. They are of the dead-tank design. Air pressure will be approximately 250 psi.

Installation will be at the Arthur Kill, Astoria, Jamaica, Corona, and North Queens Stations in New York. Since they will be installed in congested areas, the use of compressed air is preferred over the oil-filled designs previously used.

A number of these breakers will be arranged to accommodate 138-kv isolated-phase bus gear, also one of the first installation set-ups of its type in the U. S.

A-C Develops Field Coil of 'Integrated' Design

An "integrated" field coil with an insulating system designed to protect electric motors and generators against atmospheric contaminants and destructive mechanical forces has been developed by Allis-Chalmers Mfg Co.

The new field coil construction is said to be suited for applications requiring chemical resistance, oil and moisture-proofness, or sealing against contaminants such as carbon black, dust and dirt. It is available for synchronous and dc machines in Class A and B temperature classifications.

Primary insulation is glass fibres bonded to coil conductors and pole surfaces with solventless types of inorganic resins in a manner as to reportedly make the assembly one piece.

GE Completes Sound Lab for Testing Lamp Ballasts

A new sound measurement laboratory for testing fluorescent lamp ballasts has been completed and put into use by General Electric Co's Ballast Department in Danville, Ill. The laboratory is to be used for sound rating and testing of production line ballasts, and development of new designs and techniques for making quieter ballasts.

The walls, ceiling and floor of the lab are 6-in. concrete. The entire room is supported by springs which, in turn, rest on a pad of cork and rubber. All this is enclosed in an outer room of 8-in. concrete. The laboratory incorporates many other construction and design features necessary to achieve a noise level considerably below the threshold of hearing, according to the company.

M-H Develops Instrument for Measuring Lake Level

Engineers from Minneapolis-Honeywell Regulator Co's Industrial Division have developed a device which reportedly can measure a 1/50-ft change in the level of Lake Erie, which feeds Niagara Falls via the Niagara River.

The device, installed by Niagara Mohawk Power Corp, is used to keep tabs on Erie's water level. A drop of 1/10 ft in the lake level means a water loss of 2,200 cu ft a second over the falls. Electrically, this is equivalent to 48,000 kw. It is part of a system known as "a lake level telemetering system." Pressure changes sensed by a long tube projecting down into the lake are translated to water level measurements and telemetered to Niagara Mohawk's power control office in downtown Buffalo, where they are logged on a recording instrument. Thus, the dispatcher in the office is said to be able to take maximum advantages of the available water supply.

The new system is believed to be accurate, sensitive, easy to maintain and unaffected by the ice jams that frequently clog the lake in winter.

(*More M & M on page* 170)

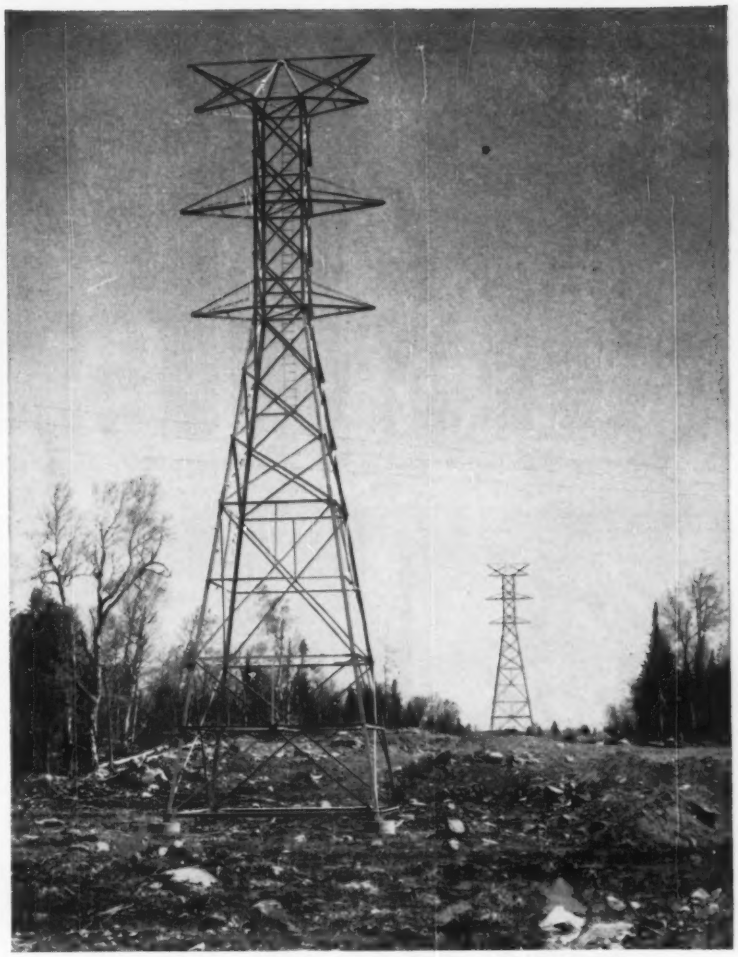
Tall Towers Help Tame North Woods At Mining Project

61-mile transmission line to be part of $300-million taconite development; carries 138 kv from power plant to mine site

About 75 miles north of Duluth, near the town of Hoyt Lakes, Minn., one of the toughest mining projects ever undertaken is approaching completion. Despite the problems of remoteness, difficult terrain and rigorous weather, it is expected that the gigantic taconite facility will be in production in 1957. Erie Mining Company — owned by a group of steel producers — will process low-grade iron ores into concentrated pellets for use in blast furnaces at the rate of 7.5 million tons yearly.

While the mines, processing plant and the newly-built town for employees are inland, the all-important power plant is at Taconite Harbor on Lake Superior, necessitating construction of a 61-mile double-circuit line. Power will be transmitted at 138 kv, and stepped down to 13,800 volts for distribution at the property.

STURDY TOWERS . . . The 309 steel towers for the line, designed and supplied by Bethlehem, were planned for unusually severe service conditions. Many of them are to be erected in treacherous muskeg — unstable, boggy soil. To counteract this the towers are constructed over heavy systems of double-channel base struts which tie the foundations together. Also, because of the long, bitter cold winters with high winds, the designers provided for ice and wind loadings 10 pct in excess of N.E.S.C. provisions.

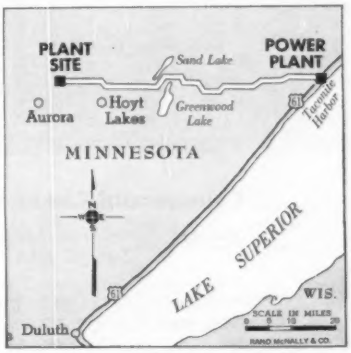


A number of newly erected 138-kv double-circuit suspension towers are shown before stringing. The boggy soil made extra bracing of the feet necessary.

The average suspension tower stands 100 ft and weighs 10 tons minimum. Design span length is 1500 ft. Bethlehem also supplied four types of angle towers: 15, 25, 35 and 90 deg.

FABRICATED AT LEETSDALE . . . The towers were detailed, fabricated and galvanized in Bethlehem's tower shop at Leetsdale, Pa., near Pittsburgh. Other Bethlehem tower-fabricating shops are at Seattle, Wash., and South San Francisco, Calif.

If you need transmission towers and switching structures, please call on the Bethlehem sales office nearest you.

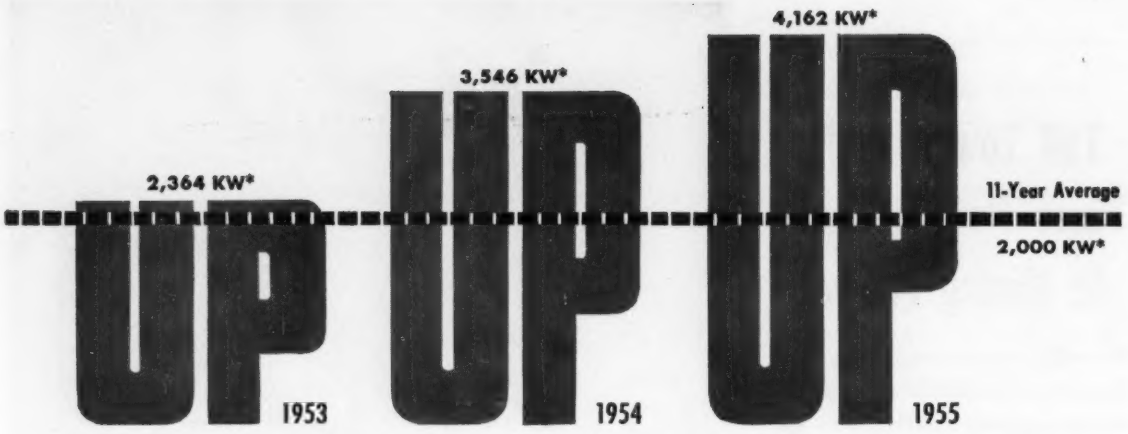


Map shows the location of Erie Mining Company's taconite project, approximately 75 miles from Duluth. Pickands Mather & Co. manages the program. Prime contractor is Hallet Construction Co.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL



Average new commercial cooking load per year per utility reporting in ELECTRICAL WORLD surveys.

		COMMERCIAL COOKING FACTS
UP!	Ohio Power Co.	Nearly $2,000,000 in new E.A.R. in 10 years
UP!	Texas Power & Light Co.	$311,000 in new E.A.R. in 1955
UP!	Minnesota Power & Light Co.	Nearly 4 kw new load per customer, 1955
UP!	Georgia Power Co.	New load up from 6,456 kw (1954) to 11,124 kw (1955)
UP!	Carolina Power & Light Co.	Commercial cooking saturation now over 15 kw per customer

"Commercial Cooking is Hot Load"

(Editorial: Reprinted from ELECTRICAL WORLD, Sept. 10, 1956, page 5)

Commercial cooking can no longer be looked upon as just a promising load building opportunity. Today it is solid business.

This is apparent to everyone who read *Electrical World's* second survey in a recent issue (Aug. 27, p. 36). Companies like Appalachian Electric Power and Pennsylvania Power & Light are grossing $2 million and more each year from this single load. Southern California Edison Co. added nearly a half-million dollars of cooking revenues last year.

And the substantial returns are by no means limited only to utilities with large prospect lists. Kentucky Power Co., with only 600 food service accounts to draw on, worked its market for $72,000 in new commercial cooking business last year. Similarly Gulf States Utilities drew $134,000 in new money from only 1,080 prospects.

Cooking kwhr sales for the industry this year likewise look good. Already they're about 25% ahead of '55, according to one equipment manufacturer's estimate.

Like space heating, commercial cooking offers a high concentration of kwhr from few installations. A fully-equipped all-electric kitchen can put a load on a utility's lines of anywhere from 100 kw for a large restaurant to 300 kw or better for a hospital. To a single company with 2,300 food-service customers (the average for the utilities in EW's survey) this means a total potential of:

- 69,000 kw demand (based on a conservative average of 30 kw for each food-service customer). This is the total capacity of a good-sized turbine generator;

"Commercial Cooking is hot load" says Electrical World

Top-management support has made Carolina Power & Light Co. a commercial cooking powerhouse for 2 decades. L. to r., John McIntyre, Hotpoint; H. G. Isley, CP&L General Sales Mgr.; E. N. Pope, Adv. and Sales Prom. Mgr.; W. P. McPherson, Com. Sales Mgr. CP&L and neighboring Duke Power are adding new commercial cooking load at a combined rate of more than 20,000 kw yearly. McIntyre's prediction: "North Carolina will be the first of the 48 states to go all-electric."

- $1¾ million in annual revenues (at $25 per kw).

And, happily enough, commercial cooking diversifies well with other classes of business, has a good annual load factor.

Utilities which go after the load know this. A survey of 34 utilities (EW July 23, p. 97) shows cooking is getting a modest but steadily increasing share of the utilities' commercial promotion dollar—up 43% since 1940. Meanwhile, several other commercial power applications are suffering budget cutbacks.

With at least 533,000 food service outlets in the U. S., whose cooking requirements could total at least 15 million kw, the "poor little rich load" is no longer so poor or so little. As for how rich it is, the figures above speak for themselves.

HOTPOINT has a complete assortment of commercial cooking plans, programs, and facts for power companies. Write, wire or phone us and we will make our full resources available to you.

Hotpoint All-Electric Commercial Cooking

Hotpoint Co., a Division of General Electric Company
Commercial Equipment Department, 265 So. Seeley Ave.,
Chicago 12, Illinois

Get the whole story . . . the inside facts about commercial cooking as analyzed by ELECTRICAL WORLD.

Please send reprint of ELECTRICAL WORLD's "2nd Commercial Cooking Survey."

NAME AND TITLE .....

COMPANY .....

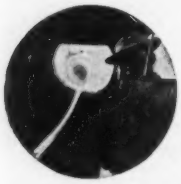
ADDRESS .....

CITY, ZONE & STATE .....

Ask these questions, too, when you judge a fluorescent lamp...

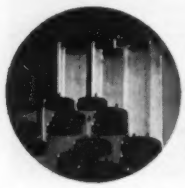
Is your investment protected?

Check Westinghouse Fluorescent Lamps against any other brands you are now using. Check them for maintained brightness, long life, uniform appearance. If you are not entirely satisfied on all counts, your full purchase price will be refunded.



Is it built with tailored glass?

Quality of glass in a fluorescent lamp directly affects lamp performance. Westinghouse makes all of its own fluorescent lamp glass, tailoring it from silica to finished tubing specifically for fluorescent service.



Is it the correct type, size and color for the lighting job to be done?

In the Westinghouse fluorescent family of 290 different lamps—including Slimline and Rapid Start—there's a type and size precisely right for every office, plant and merchandising application. Colors include seven different shades of "white" alone.

For the full story on how to get more for your money in fluorescent light, contact your Westinghouse Lamp Representative.

WATCH WESTINGHOUSE

WHERE BIG THINGS ARE HAPPENING FOR YOU!

Kaiser Aluminum Gets Third Extrusion Plant

Kaiser Aluminum & Chemical Corp has acquired the Hokin Aluminum Co extrusion plant located at Dolton, Ill., near Chicago. This will be the third extrusion plant for Kaiser Aluminum.

The 350,000-sq ft production facility includes five extrusion presses. Its annual capacity will be approximately 18 million pounds of extruded aluminum shapes and tubing. This acquisition will enable the firm to speed up by approximately two years the company's planned Midwest extrusion expansion program, eliminating the delay of constructing a new plant, according to D. A. Rhoades, vice president of Kaiser Aluminum.

Los Angeles W&P to Have RCA Microwave System

A multi-circuit microwave radio relay system will provide across-mountain communications for various offices of the Los Angeles, Calif., Department of Water and Power. It is being installed by Radio Corporation of America.

The RCA system links the Department's main offices in Los Angeles with a city power plant in Van Nuys, Calif., approximately 15 miles away, and operates through a repeater station mounted atop Lookout Mountain.

The system utilizes RCA MM-26A microwave equipment, operating in the 2450-to-2700 megacycle band. It provides 12 circuits for voice communications and two tone circuits. The tone circuits are for use in VHF control service to provide communication among the microwave stations and radio-equipped mobile units.

ACCO Wire Rope Tester Reported Good for 300 Tons

A recent development in wire-rope and mechanical-splice testing facilities is a new 300-ton capacity hydraulic prooftester installed at the Wilkes-Barre, Pa., plant of American Chain and Cable Co.

Designed in cooperation with ACCO engineers, the big tester was built and installed by Baldwin-Lima-Hamilton Corp of Eddystone, Pa. It was designed to meet the testing needs of improved strength wire ropes and mechanical splices, specifically, ACCO's VHS (Very High Strength) wire rope and Dualoc splices. It is said to have a capacity of 600,000 lb, and is reportedly unique in that it can accommodate specimens up to 60 ft long for proof- and break-testing.

PLANT EXPANSIONS

• A 58,000-sq ft, half-million-dollar plant for the production of electronic air cleaning equipment and temperature control parts will be built in Wabash, Ind., by Minneapolis-Honeywell Regulator Co, according to Paul B. Wishart, president.

• Production and warehouse space has been more than doubled by a recent move to the new quarters of Everwarm, Inc, at 2925 N. Central Ave, Knoxville, Tenn., according to the company. Everwarm manufactures radiant heating cable, electric wall-insert heaters, and portable electric heaters.

• A 32-acre, 730,000-sq ft facility belonging to Savage Arms Corp at Utica, N. Y., has been purchased by Remington Rand Division of Sperry Rand Corp. The Utica plant will produce a new line of products for Remington Rand's Univac division, it is reported.

• A new wire and cable production facility, consisting of a 92,000-sq ft building on a 13.5-acre site, has been opened recently by Telecables and Wires Ltd, and Canada Wire and Cable Co, Ltd, at Fort Garry, Manitoba, Canada. When full one-shift production is reached, it is expected that the plant will employ about 75 to 100 persons.

• Homelite, a division of Textron, Inc, Port Chester, N. Y., has plans for a 135,000-sq ft factory building at Gastonia, N. C., for production of its gasoline-powered chain saws. Construction of the $2 million plant will begin this month and full operation is expected by the fall of 1957. Approximately $1½ million annual payroll is anticipated.

(*M & M Briefs on page* 172)

how to judge a fluorescent lamp . . . point no. **9**

ask about **ELECTRODE QUALITY**

Better electrodes in a fluorescent lamp mean *longer lamp life*. That's why Westinghouse cuts no corners in its electrode manufacture. All Westinghouse electrode coil wire, for example, is drawn through diamond dies. Some of it has to be drawn so fine that a single pound will extend from New York to Pittsburgh. Thanks to constant development of new and better ways to make fluorescent lamp electrodes, Westinghouse has *tripled* the life of its fluorescent lamps since 1948.

WATCH WESTINGHOUSE

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***

Before: Beat-up

Now: Like new!

G-E Service Shop

Your local G-E Service Shop uses mass-production methods when it rebuilds your old distribution transformers. Result: high-quality work at low cost . . . prompt pickup and delivery . . . and no worries for you. And you get new-unit warranties! There are 52 G-E Service Shops throughout the country—one near you. 431-32

Progress Is Our Most Important Product

GENERAL ELECTRIC

M&M BRIEFS

Square D Co has purchased three acres of land in Burnaby, British Columbia. The company is planning a $500,000 plant, but no development will take place for a year or two.

Minneapolis-Honeywell Regulator Co has purchased Davies Laboratories, Inc, of Beltsvile, Md., manufacturer of specialized high-speed data recording systems.

Tork Time Controls, Inc, a title more symbolic of the purpose of time switches, is the new name of reorganized time switch manufacturer, the 35-year-old Tork Clock Co, Inc, of Mount Vernon, N. Y., according to Cyril J. White, president.

DuPont & Co, Polychemicals Department, Wilmington, Del., is evaluating a new plastics material called "Teflon" 100-X perflurocarbon resin as a supplement to the company's present line of "Teflon" tetrafluroethylene resins, used in high temperature electrical insulation, chemical-resistant hose, packing and gaskets.

DeHavilland Engine Co, London, England, is soon to begin work on design studies for a new British nuclear-powered gas turbine project. The work will involve designs for both gas turbines and steam turbines that are suitable for use with nuclear reactor power units.

Sprague Electric Co, North Adams, Mass., has acquired a controlling interest in CREAS, a small capacitor manufacturer in Milan, Italy. Sprague expects the move to re-open the electronics market in Europe and the Near East for them, which has been closed to their 11 American plants, largely because of import restrictions and dollar shortages. No CREAS imports to the U. S. are anticipated.

Metropolitan-Vickers Electrical Co, Manchester, England, has received orders worth $620,000 for an electrical generating plant for Canada's first nuclear power plant on the Ontario River to be operated by Ontario Hydro-Electric Power Commission. The station will comprise a reactor, boiler plant, and generating plant; former to be built by General Electric Co, Ltd.

INDIANA STEEL & WIRE CO. MUNCIE, IND. — Crapo Galvanizing

Signs along the lines of *Crapo* GALVANIZED STEEL STRAND PERFORMANCE

For dependable performance . . . insist upon *Crapo* Galvanized Steel Strand. Superior tensile strength, combined with long-life, ruggedness and workability, makes *Crapo* Steel Strand first choice for guys, messenger and overhead ground wire.

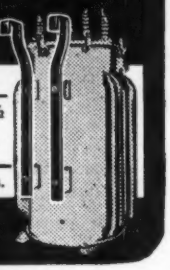
The famous *Crapo* galvanizing process provides dependable protection for the steel, prolongs the expectant life of the strand.

- Low maintenance cost
- Laboratory tested and controlled quality
- Meets highest quality standards
- A size and grade for all practical needs
- Contact your *Crapo* Jobber Today!

INDIANA
STEEL & WIRE CO., INC.
Muncie, Indiana

THIEL
TRANSFORMER HANGERS

MODEL	C-1	C-3
TRANSFORMER	75-100 KVA Single-Phase	75-112½ KVA Three-Phase
WEIGHT	46 lbs.	100 lbs.

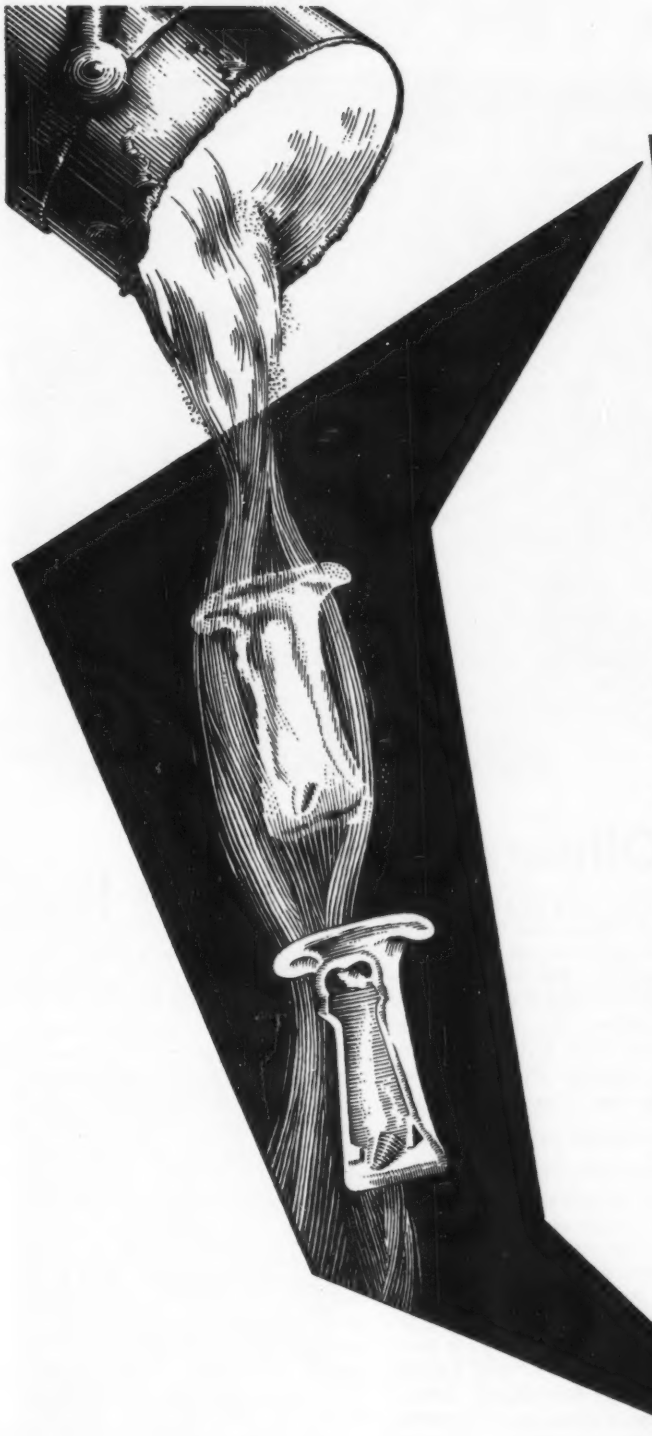


● Thiel Hangers are made according to NEMA specifications—heavy gauge steel construction, hot-dip galvanized for dependable service and long life. Two styles complete with galvanized bolts and nuts. In stock for immediate delivery.

T-TYPE HANGERS in two sizes. For 3-50 KVA 1-Phase and 9-45 KVA 3-Phase transformers.

HANGER KICKERS in sizes to fit T-type hangers.

THIEL TOOL AND ENGINEERING CO. INC.
1417 No. Market St. • St. Louis 6, Mo.



WHY... more hardware performance per dollar with M|F MALLEABLE IRON

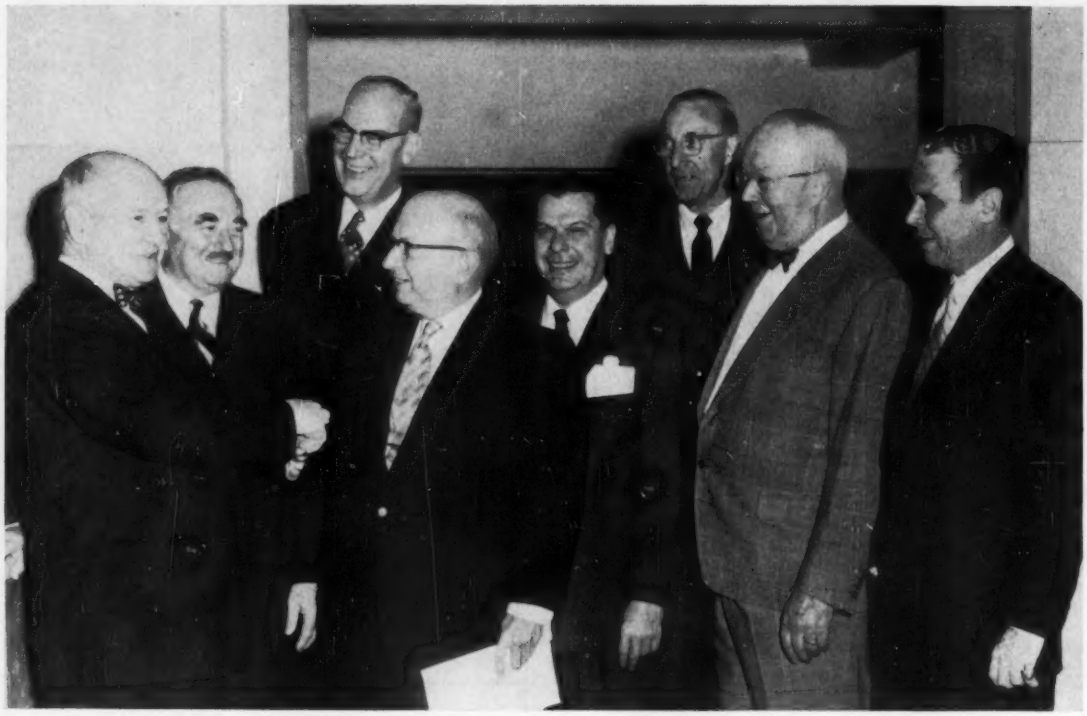
All iron and steel starts out in the molten state. Malleable iron is cast directly into a designed — *finished* piece, then hot dip galvanized. Rarely are machining or finishing operations required.

Steel is cast, then, in addition — sheeted, rolled, cut, stamped, punched, or forged, or machined, or welded, and finally — after many operations the hardware is galvanized.

M.I.F. foundry techniques eliminate these *extra* operations, and at the same time allow designing and casting the shapes that provide better performance and easier, faster installations. Those economies, plus high corrosion resistance, are why MALLEABLE IRON POLE HARDWARE gives more performance per dollar. Our new illustrated price list will prove it. Send for your copy!

MALLEABLE IRON FITTINGS CO.
POLE HARDWARE DIVISION • BRANFORD • CONN.

M|F



NEMA Elects New Officers for 1956-57

National Electrical Manufacturers Association has announced the election of Arthur A. Berard as new President to replace J. W. Corey. The election took place at the 30th Annual Meeting held recently at Atlantic City, N. J. where F. F. Loock, president of Allen-Bradley Co, was named to assume Berard's former post of treasurer.

Of the five vice presidents named this year at NEMA, one is newly elected and four are re-elected. The newly named vice president is N. J. MacDonald, president of Thomas & Betts Co.

The four re-elected are B. C. Neece, president of Landers, Frary & Clark; W. V. O'Brien, vice president and general manager of Apparatus Sales Division of General Electric Co; J. L. Singleton, vice president of Allis-Chalmers Manufacturing Co; and J. J. Mullen, president of Moloney Electric Co.

Members of the board appointed as members-at-large of the Officers Committee are J. R. MacDonald, chairman of the board and president of General Cable Corp; and J. H. Jewell, vice president of Westinghouse Electric Corp. The Board also appointed two new members: George T. Pfleger, president of U. S. Electrical Motors, Inc; and Joseph S. Thompson, president of Federal Pacific Electric Co.

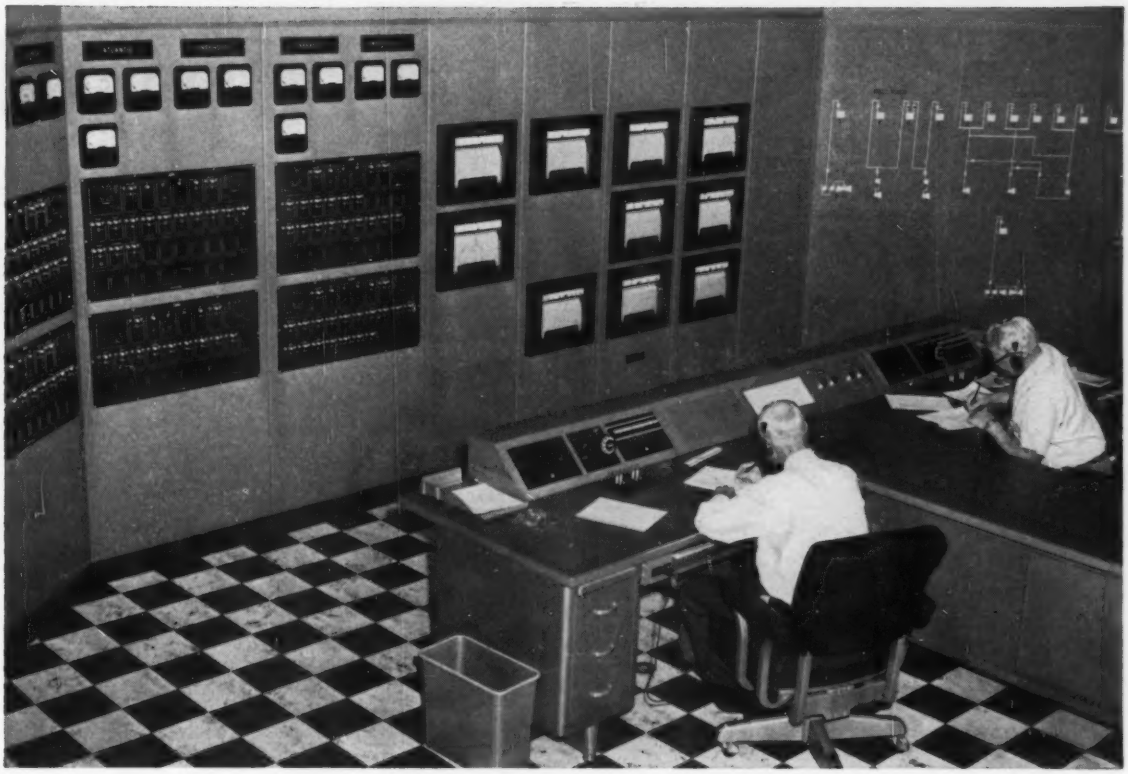
Fourteen Named to Board

Fourteen men were appointed to the board of governors; one for a single year term and the remaining thirteen are to serve on the board for a three-year period. W. R. Persons, president of the Emerson Electric Manufacturing Co was elected for one year and the following for three years: J. E. Bixler, Duncan Electric Manufacturing Co; Smith Bolton, U. S. Graphite Co, division of Wickes Corp; T. Pierre Champion, Champion Rivet Co; J. W. Corey; A. C. Flood, Howell Electric Motors Co; C. W. Higbee, U. S. Rubber Co; F. F. Loock; H. C. McElhone, Lamb Electric Co; J. J. Mullen Jr; D. J. O'Conor Jr, Formica Corp; J. C. Sharp, Hotpoint Co; J. L. Singleton; Chris J. Witting, Westinghouse Electric Corp.

Berard, currently president of Ward Leonard Electric Co succeeds J. W. Corey, president of Reliance Electric & Engineering Co since 1944. Berard, who joined Ward Leonard Electric Co in 1920 as a salesman, moved quickly and successively to board of directors in 1927, general sales manager in 1930, executive vice president and general manager in 1944 and finally president in 1948.

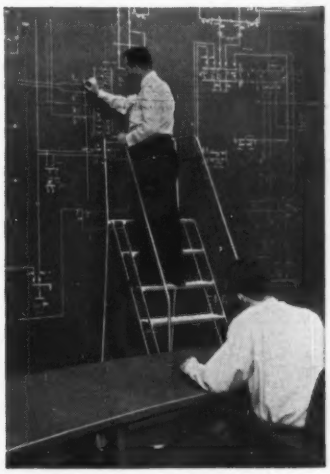
Also, during the meeting at Atlantic City, Berard received the Manufacturers Medal and Purse given under the James H. McGraw Award for Electrical Men for his distinguished service to the industry. The other winner of this award was V. Robins Tate, executive vice president of the Perfex Corp.

The outgoing president Cory (above left) congratulates incoming president, Berard (fourth from left). Others in the picture (l to r) are N. J. MacDonald, Singelton, Neice, O'Brien, Loock and Mullen.



This new Systems Operations Center of the Jersey Central Power & Light Company keeps in touch with remote stations through Bell System channels for telemetering and remote control.

Bell System communications help Jersey Central regulate power transmission



Colored pegs in wall diagram indicate segments of line to be isolated for maintenance work.

Channels for telemetering and remote control enable the Jersey Central Power & Light Company to regulate power transmission every step of the way from generator to home, store and factory.

An engineer glances at the dials, which give him a running picture of the system and the changing demands he has to meet—information which has been brought to him by Bell System telemetering channels.

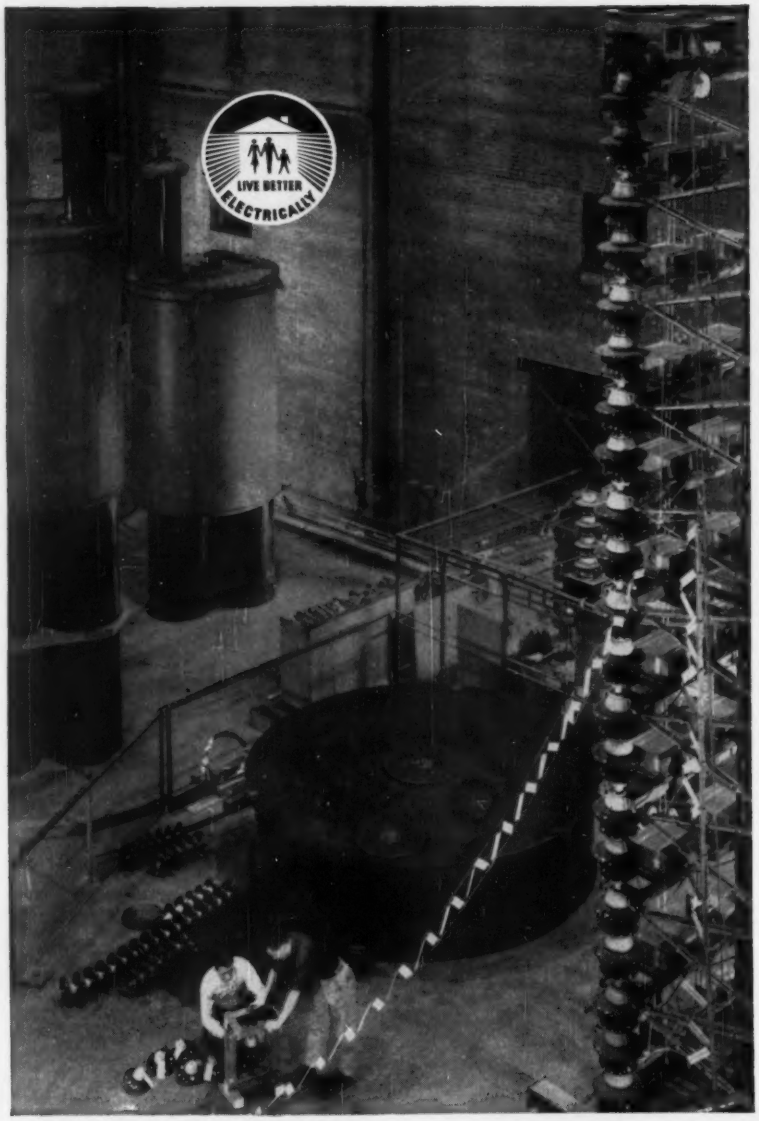
From his position, he switches loads, starts and stops generators and localizes failures—even at distant points—over a network of remote control channels provided and maintained by the Bell System.

If you would like to know more about how Bell System communications can help you, an engineer will be glad to survey your company's needs. There's no obligation. Why not call your Bell Telephone representative today?

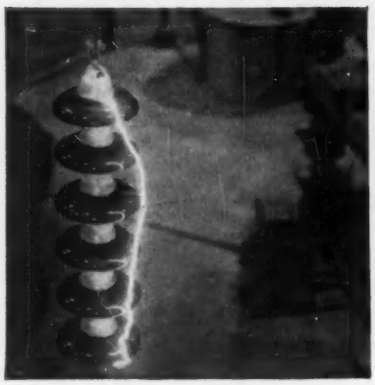
BELL TELEPHONE SYSTEM

Private Line Telephone, Private Line Teletypewriter
Channels for: Data Transmission, Telemetering, Remote Control, Telephotograph, Closed Circuit TV

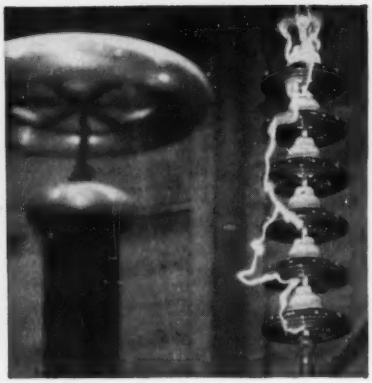
How good



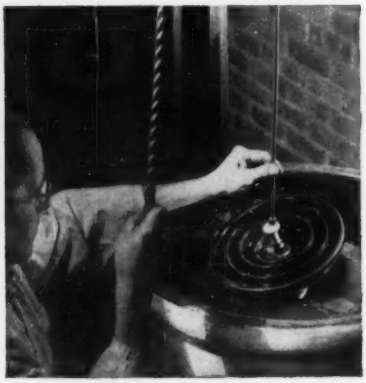
HIGH VOLTAGE LABORATORY of the Insulator Department is staffed and equipped for the technical evaluation of today's insulators and tomorrow's designs. The impulse generator at left has 3 million Volt capacity and is shown being prepared for steep wave front test. Low frequency test potentials up to 1 million Volts, as required for flashover, puncture and radio noise tests are delivered by transformers in background. These facilities, as those for research and design, are our means for solving your insulator problems.



IMPULSE FLASHOVER—600,000 volt discharge indicates insulator string's resistance to natural lightning.



60-CYCLE FLASHOVER at 400,000 volts helps evaluate insulator design and ability to withstand operating voltages.



PUNCTURE TEST, conducted to destruction in insulating oil to prevent external flashover, tests dielectric strength.

can an insulator be?

Consider what these

LABORATORY TESTS

mean to an insulator... and to you!

Moving the conditions of your lines and weather into our plant is part of the job of final testing all types of Locke* insulators . . . suspension, apparatus, pin type and others.

Each day, production samples of insulators go to the high voltage laboratory for destructive control tests, to check their mechanical and electrical strength. This constant quality control assures you of uniform insulator dependability, year after year, mile after mile.

In addition, many special test programs are carried out in this and other General Electric laboratories to provide our engineers with guidance in developing more effective designs and stronger materials.

The illustrations below show a few of the control and special tests performed regularly. They are typical of the extremes to which General Electric goes to give you trouble-free service from insulators on your system.

For a brief and complete picture story of insulator quality control, just call your General Electric Insulator representative or write to Insulator Department, General Electric Company, Baltimore, Maryland.

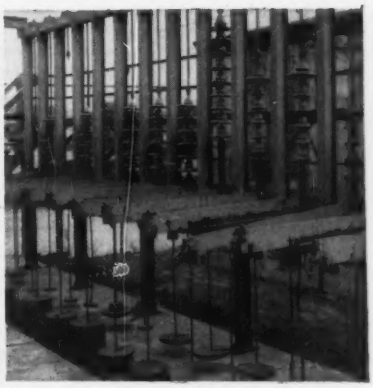
*Trademark of General Electric Company

Progress Is Our Most Important Product

GENERAL ELECTRIC

IMPACT TEST subjects samples to hammer blows of increasing severity, proving the capabilities of production insulators to withstand mechanical shock.

THERMAL SHOCK, alternate submersion in freezing and boiling water, goes far beyond normal service requirements to assure highest porcelain quality.



TIME LOADING TEST loads insulators in excess of normal service. Low frequency flashover tests check continuing electrical integrity of each unit.

NELPA Appoints Krieg Manager

Northwest Electric Light & Power Association has designated Alden F. Krieg as new executive manager. Krieg joined Portland General Electric Co in 1948 as a commercial sales engineer, but has been on leave of absence from the company for the past two years to serve as executive secretary of the City of Portland's Exposition-Recreation Commission.

Krieg is replacing Berkeley Snow in his new capacity. Snow, who served as executive manager for the 29 years, started with the association as secretary and will retire on Dec. 1.

ALDEN F. KRIEG

N. J. Utilities Association Names Head

Watson F. Tait, Jr, currently vice president in charge of electric operation, Public Service Electric & Gas Co, was elected president of the New Jersey Utilities Association at its 41st Annual Meeting in Absecon, N. J. this month. Tait, associated with the electric department ever since he joined the company in 1922 as a cadet engineer, was appointed general manager in 1948 and has held his present post as VP since 1950.

Elected vice president of the association was Charles E. Kohlhepp, president, Jersey Central Power & Light Co and of New Jersey Power & Light Co.

WATSON F. TAIT, JR

PERSONAL BRIEFS

Woodrow W. Benton has been designated community development coordinator for Mississippi Power & Light Co. Benton replaced **Thomas B. Worely,** newly named Northern Division Manager.

When Illinois Power Co took over as power supplier for the city of Salem, **W. M. Reese** became district manager at Salem Electric plant.

R. E. Kennedy will head up West Texas Utilities Co's new public service department, a consolidation of the advertising and industrial departments.

J. Franklin Smith becomes manager of Pennsylvania Electric Co's Bedford district with the retirement of **John S. Brice.** Brice served the company for 46 years.

Gulf States Utilities Co has announced the following promotions: **Albert Baird** operating supervisor, **J. L. Powdrill** division engineer, **W. H. Caswell** and **P. L. Davis,** section heads all at Beaumont; **J. C. Hays** and **C. H. Harris** at Baton Rouge.

Philadelphia Electric Co announced the retirement of **Edward Porter,** senior vice president.

Vice president of West Penn Power Co, **Joseph O. Chambers** has been given the added responsibility for the utility's engineering functions.

Lawrence G. Roberts succeeds **Thomas F. Hanley,** retired as treasurer and assistant secretary for the Omaha Public Power District.

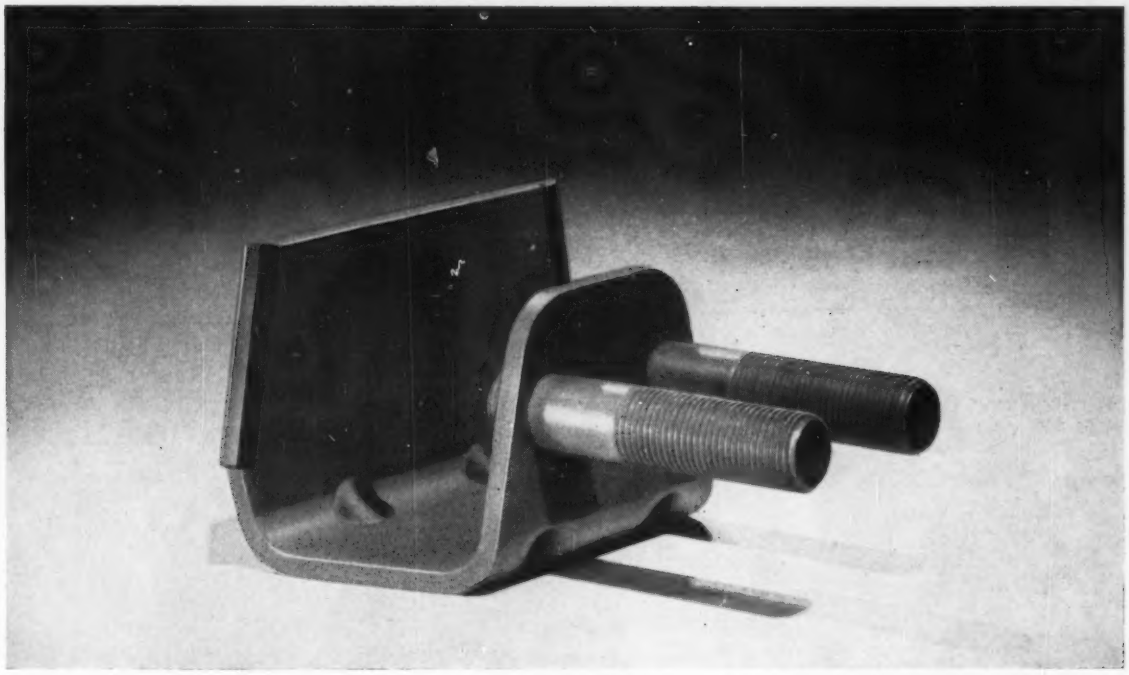
James D. Maguire, formerly manager of Oklahoma Gas & Electric Co's Holdenville district has moved up to manager of Seminole district. He is being replaced by **Cecil A. Sanders** who had previously been assistant auditor for the Eastern Division.

Lionel M. Searle has been named vice president and general manager of Philo Corp's Automotive division, replacing **William H. Chaffee,** resigned.

Four Wheel Drive Auto Co has promoted **Wesley H. Peters** to manager of their Ground Support Equipment Division.

Westinghouse Electric Corp's Transformer Division has appointed **R. N. McCollom** to manage its newly-formed power transformer department. **H. B. West** becomes assistant manager and **J. C. Rissinger** was named sales manager . . . Four appointments for the northeastern region of WE are **Edward C. Delano** assistant to vice president, **Paul B. Shiring** assistant manager of Boston district, **Frederick R. Malone** regional electric utility sales manager, and **William G. Cheney** area sales manager of the New York City district.

Dr. James K. Sprinkle is new applied research engineer for the applied research and development laboratory of General Electric Co's foundry department . . . **William W. Smith** has been named manager of GE's service entrance equipment sales . . . GE's Lamp Division has announced the retirement of **George E. Nelson.** Named as successor to **Nelson** is **Michael C. Finn** as manager of northern sales district. **William J. Speckerman,** new retail sales specialist, replaces Finn and **William M. Kirkpatrick** will take over for Speckerman.



Mallory Contact Design Service Saved Nearly 50% For an Electrical Equipment Manufacturer

A large electrical equipment manufacturer required heavy duty contacts for a new product design. The original specifications and tolerances indicated this contact should be made from oversize copper stock—formed—inserts brazed in place—and the complete assembly straddle-milled to finished dimensions.

Mallory Contact Design Service proposed an alternate design. They developed a method to use smaller stock—braze the contact inserts—grind to required thickness—then form the contact shape.

The equipment manufacturer benefitted because the cost of machining operations and of oversize stock were eliminated. The cold working of the contact piece resulted in extra strength, giving it a longer life potential. Actual cash savings of nearly 50% were passed on to the customer —thanks to Mallory's contact design engineering.

FIVE *MALLORY* KEYS TO ECONOMY THROUGH CONTACT ENGINEERING

1. The most effective contact material from the extensive line developed by Mallory. More economical alloys often can satisfy *actual* service conditions.
2. The most economical contact design . . . for your purchasing, production and product needs.
3. The most economical backing material . . . from a group of Mallory alloys developed for this use.
4. The most economical backing member design in relation to contact and product design requirements.
5. The most economical method of assembling contact and backing member.

By coordinating *all* these important elements of contact design, Mallory can help you put into effect a long-range plan for cutting contact cost and assuring peak performance.

Write or call Mallory for a consultation.

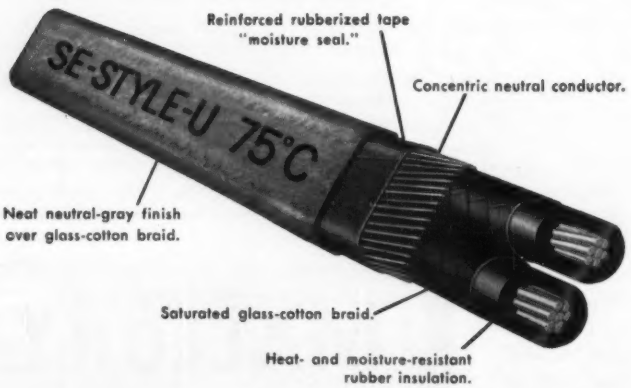
Serving Industry with These Products:

Electromechanical — Resistors • Switches • Tuning Devices • Vibrators
Electrochemical — Capacitors • Mercury and Zinc-Carbon Batteries
Metallurgical — Contacts • Special Metals • Welding Materials

P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

Neither heat nor rain will damage this installation of Rome Service Entrance cable. Easy to work, the cable permits neat installations.

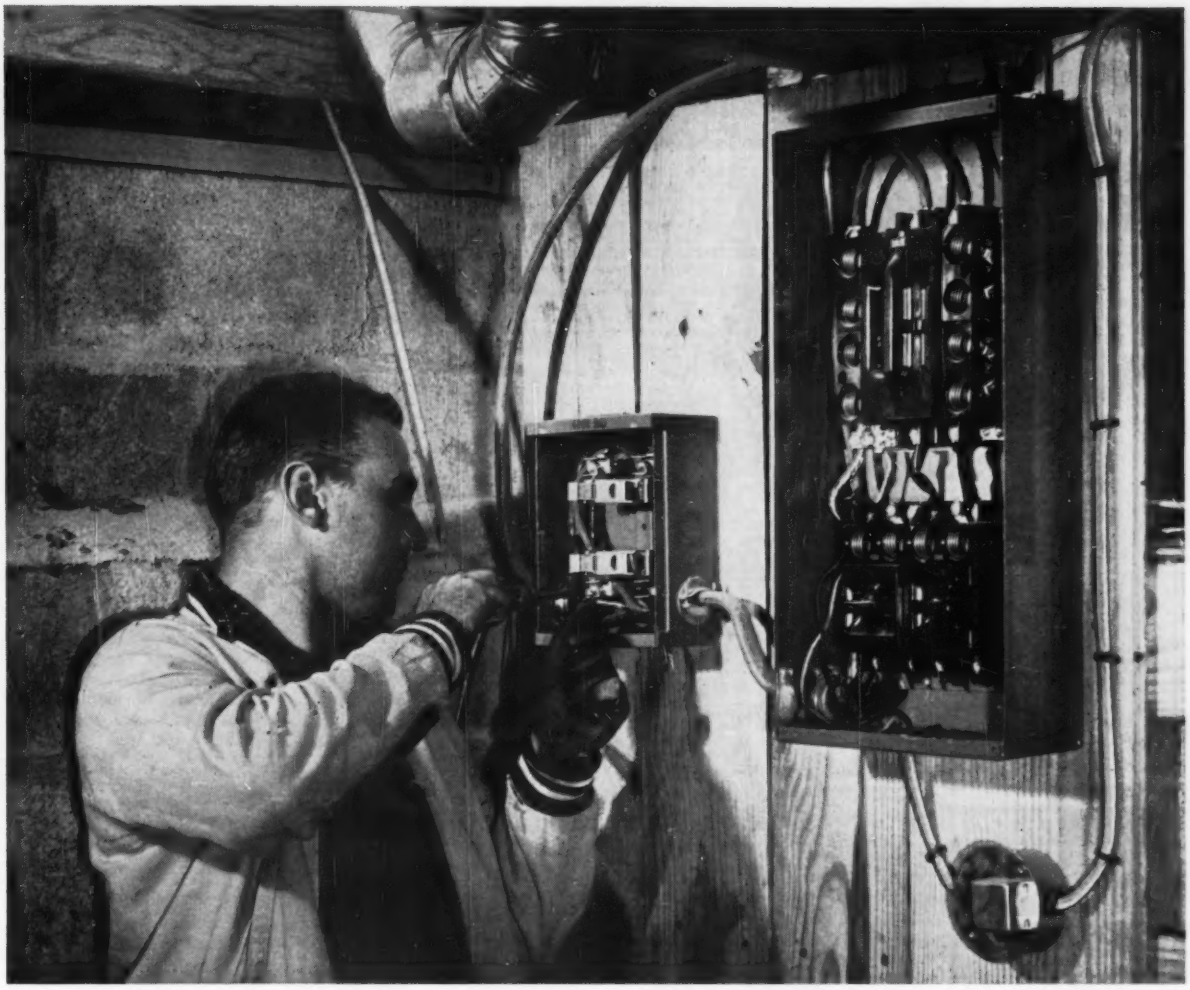
New Rome service entrance cable


Reinforced rubberized tape "moisture seal."
Concentric neutral conductor.
SE-STYLE-U 75°C
Neat neutral-gray finish over glass-cotton braid.
Saturated glass-cotton braid.
Heat- and moisture-resistant rubber insulation.

Rome's new and improved Type SE service entrance cable is the ideal selection for new and re-wired 100 ampere service. It fully meets all the requirements for a service entrance cable that can handle all the electric appliances and air conditioning needs of modern living.

In addition, this versatile cable may enable you to reduce warehouse inventory levels and the amount of cable carried in your service trucks. The same cable can be used:

1. From pole to meter
2. From service drop to meter
3. And from meter to electric range, washing machine, clothes dryer, hot water heater, etc.



Rome Type SE service entrance cable can be used: 1. From pole to meter; 2. From service drop to meter; 3. From meter to electric range, etc.

designed for modern 100 ampere service

Other features of Rome's Type SE cable include:

1. The outer glass-cotton braid is finished to give the cable a neat appearance without sacrificing flame and moisture resistance. This neutral gray finish can be painted, if desired, to match the color of the building on which the cable is installed. It withstands severe storage and service conditions without deteriorating and becoming tacky.
2. The glass-cotton braid on each conductor—one red and one black—is clean, permanent, and provides easy conductor identification. For easy and positive exterior identification, the outside of the cable is surface printed "SE-Style U 75°C."
3. Underwriters' approved for 75°C. operation in *either dry or wet* locations. A reinforced rubberized tape under the weather-resistant outer braid puts the assembled conductors in a "dry location." In addition, the moisture seal provides added protection against cutting by clamps and other fittings, increasing service life.
4. In three conductor construction for 100 ampere service, Underwriters' approval makes possible the use of size 3 AWG copper conductors, or two conductors of size 3 AWG with a neutral conductor of size 5 AWG.

Specify Rome service entrance cable for your next job. Contact your nearest Rome Cable representative for more information—or write to Department 365-A and ask for Bulletin SE-1. Rome Cable Corporation, Rome, N. Y.

ROME CABLE

CORPORATION

SEARCHLIGHT SECTION

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BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

TRANSFORMERS

FOR SALE

3—1000 KVA Mol 11500-2400/4160Y
3—1000 KVA Mol 13200-2400/4160Y
3— 500 KVA W-H 33000-2400/4160Y
3— 500 KVA G-E 22000-2300/4000Y
3— 500 KVA G-E 13200-240/4160Y
3— 333 KVA A-Ch 14400/14100/13800/13500/13200-240/480
3— 250 KVA G-E Ditto
3— 167 KVA W-H Ditto
6— 250 KVA W-H 22000-7200/12470Y
3— 200 KVA Mol 7200/12470Y-2400/4160Y
4— 100 KVA A-Ch 33000-7200/12470Y
4— 100 KVA W-H 22000-6900/11950Y

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.

5316 Hetzel St.
Cincinnati 27, Ohio

40 Years' Dependable Service

ELECTRICAL WIRE AND CABLE

—YOUR BEST SOURCE—
• for every industrial and power application
• Odd lengths—long and short—reasonably priced

One of the Largest Stocks in the Midwest

Let us quote on requirements—
send your inquiries
We'll also buy your Surplus

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FOR YOUR TEMPORARY NEEDS TRY OUR SURPLUS DIVISION

UNIVERSAL WIRE and CABLE CO.

2929 N. Paulina St. — Chicago 13, Ill.
EAstgate 7-4777 — Code: UNIWIRE

FOR SALE
1875 KW MOTOR GENERATOR SET

1875 KW General Electric generator, 250 volts direct current, direct connected 2600 HP General Electric synchronous motor, 3 phase, 60 cycle, 11,000 volts, 600 RPM, complete with automatic switchgear. Excellent condition.

INTERNATIONAL POWER MACHINERY CO.
Union Commerce Bldg. — Cleveland 14, Ohio

LARGE POWER EQUIPMENT

Prompt Stock Shipment
RENUBILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
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BUSINESS OPPORTUNITY

British Public Company with wide production facilities in light engineering, electrical and electronic fields requires to tie up with an American Company, with a view to manufacturing new products in the United Kingdom. BO-3497, Electrical World.

U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-4802) will be received at Denver, Colorado, until December 13, 1956, for furnishing one 230-kv (900-kv BIL), 1,200-ampere, 5,000,000-kva, 3-cycle interruption, power circuit breaker for Granite Falls Substation, Missouri River Basin Project, South Dakota. Delivery is desired within 27 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

REPLIES (Box No.): Address to office nearest you
c/o This publication Classified Adv. Div.
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CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
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POSITIONS VACANT

Distribution Engineer EE for rural power system in Minnesota. Work involves planning, operating studies and related distribution problems. Experience desirable but not essential. Salary commensurate with qualifications and experience. Replies will be considered confidential. Send application to P-3369, Electrical World.

Electrical Engineers—Excellent opportunities available for recent electrical engineering graduates in one of Midwest's largest utilities. Openings in all phases of utility engineering operations. Generous company paid retirement, hospitalization and other benefits. Send full resume. P-3462, Electrical World.

Wanted: By Sales Department of major primary aluminum manufacturer. Electrical engineer to help users of aluminum electrical conductors to overcome technical problems and to coordinate customer requirements for aluminum conductors with manufacturing capabilities. Basic requirements: Graduate Electrical Engineer, practical experience with design of electrical power equipment or systems, age preferably between 30 and 40. Salary commensurate with qualifications. Address inquiries to: P-3435, Electrical World.

POSITIONS WANTED

Available January 1, 1957, qualified electric steam or diesel power plant Supt. Years of experience in operating, maintenance, heavy construction. References. PW-3474, Electrical World.

Electrical Engineer—Desires challenging, responsible position in electric power field. Thoroughly experienced in high and low voltages, excellent references, capable, young, mentally alert and flexible. PW-3518, Electrical World.

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New and Used Equipment Available for
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EBASCO SERVICES INCORPORATED
APPARATUS EXCHANGE — Two Rector St., New York 6, N. Y.

SALES ASSIGNMENTS

COMPANY STAFFS

Allis-Chalmers' industries group has appointed G. E. Conn manager of its Buffalo district. MacGregor G. Jones succeeds Conn as manager of the York district. . . . Charles F. O'Riordan is new manager of the midwest region, succeeding J. F. Burrus who recently became assistant general manager in AC's Power Equipment Division and Joseph M. Duncan replaces O'Riordan as manager at Atlanta. . . . O. V. Tally was named manager of the Washington district; R. N. Landreth will serve on the industries group sales staff.

General Electric Co has elected Harold W. Fisher to manager of sales to distributors, contractors and users for the specialty transformer department.

Line Material Co has made Charles L. Snail field engineer to represent them in northeastern Kansas and northwestern Missouri.

Sylvania Electric Products, Inc, recently named J. Clayton Stephens district sales manager of lighting for Los Angeles area. . . . In the Portland area Garland R. Barlogi becomes district sales supervisor of lighting. . . . Thomas J. Holland will assume the post of district sales manager for lighting in the Seattle area.

Westinghouse Electric Corporation has designated Paul B. Shiring to replace Edward C. Delano as manager of the Boston district. Frederick R. Malone will become regional electric utility sales manager and William G. Cheney a sales manager of New York City district.

Ice Harbor Dam Slates 1961 Completion Date

Ice Harbor Dam power will be on the line by 1961, say the Corps of Engineers, in announcing that navigation on the lower Snake River to Lewiston, Idaho, must be curtailed during the construction period.

Construction of the first step cofferdam for the $135-million multipurpose project was begun Aug. 21 by the Guy F. Atkinson Co. This is the southshore cofferdam.

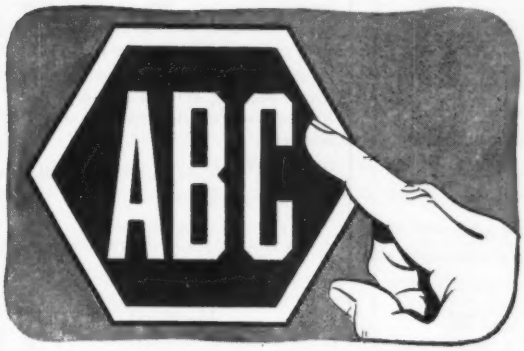
Bids on first construction work behind the cofferdam will be opened Nov. 27, according to Col Myron E. Page, Jr, Walla Walla, Wash. district engineer.

Navigation interests have approved the stepped-up construction schedule for the dam which requires curtailment of barge traffic on the Snake. Colonel Page said savings in construction time and money justify the schedule.

The Reader Is Boss

or... How ABC Helps You Run The Magazine Business

Readers who pay for magazines are always ripe for new ideas, new information, new trends and new technological developments. By giving or withholding their subscription money, reader-customers vote for or against editors and publishers. Counting these "votes" is the important job of the *Audit Bureau of Circulations* – the watchdog of the publishing industry.



YOU CAN TELL which magazines have fully-audited paid circulation when you see the ABC symbol on their cover or contents page. This is the symbol that stands for the Audit Bureau of Circulations, a cooperative organization that sets standards of good business conduct for its publisher members.

ACCURATE FIGURES – ABOUT YOU are the heart of ABC's job. ABC does a candid, unbiased, certified audit of all subscription figures of member magazines – and of the subscribers' jobs, functions, and locations. These audits help editors to tailor the contents of their magazine to your specific job interests.

YOU'RE THE BOSS when you pay money for any magazine. Your vote of confidence and your renewals of subscriptions are dominant in the thinking of editors and publishers. Advertisers are vitally interested, too, and their support helps earn the dollars needed to do a stronger, more useful editorial job for you.

YOU, THE SUBSCRIBER, WIN when you buy ABC magazines, for this mark is your assurance that you are getting a publication tailored to your needs. McGraw-Hill has been a charter member of ABC and has supported its aims continuously for over 40 years. And ABC, in turn, is responsible in many respects for the high standard of business magazine publishing today.

McGRAW-HILL MAGAZINES

McGRAW-HILL PUBLISHING COMPANY, INC.

330 WEST 42nd STREET, NEW YORK 36, N. Y.

NATIONAL COVERAGE

EMPLOYMENT OPPORTUNITIES

DISPLAYED — RATES — UNDISPLAYED

The advertising rate is $19.15 per inch for all advertising appearing on other than a contract basis.

An Advertising inch is measured ⅞" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

$1.50 per line, minimum 3 lines.

Box Numbers—counts as 1 line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Not subject to Agency Commission.

Send NEW ADS to Classified Advertising Div. of ELECTRICAL WORLD, P.O. Box 12, N. Y. 36, N. Y.

WANTED:
ENGINEERING TALENT

PRODUCT . . . PLANT . . . SALES

This growing company is in need of additional engineering help to work in several categories. College education, or equivalent, is desirable in either electrical or mechanical engineering. Opportunity is excellent, limited only by the initiative, imagination, and energy of the individual. At Lapp everyone is given opportunity to accept as much responsibility as he is willing to carry.

Living is pleasant in this small, prosperous Western New York community, with its excellent schools, fine community spirit, recreational facilities and accessibility to the larger cities. Located on the New York State Thruway, Le Roy is readily accessible to a huge east-west belt of some of the most delightful vacation and important business areas of the country.

Specifically needed at this time is a product engineer who, depending on his detailed background and experience, would promptly be given responsibility for one or more major product lines of the Lapp Insulator Co. Designing ability and industrial experience would provide background for this work.

There is requirement for one or two plant engineers. Industrial experience affords the best background for this particular job. The work would be mostly in connection with the design and manufacture of process equipment, as well as special machinery for more economical production.

Another position open is that of sales engineer. Desirable background would be design or operating experience in an electric utility—or experience gained in selling these products to utility companies. Some traveling would be involved, although it would be by no means constant.

These positions in this successful and rapidly-growing company offer a future limited only by the ability and aggressiveness of the individual, and the community provides happy living conditions for the entire family. Salaries are open and would depend on background and experience. All replies will be held confidential. We will pay traveling expenses incidental to an interview.

LAPP INSULATOR CO., INC.
LE ROY, NEW YORK

MANAGER
Thermal Power Plant Engineering

Exceptional opportunity with major engineering firm for executive engineer with M.E. or E.E. degree, (power option), 10 to 15 years progressive experience in design, layout and project engineering of thermal power plants.

Excellent salary, live in mild West Coast climate, year around recreation, new schools. Unique perquisites —free family health plan, retirement, moving allowance, etc. Unlimited future, challenging assignment.

Write in strictest confidence, stating salary required.

P-3499, Electrical World
68 Post St., San Francisco 4, Calif.

Wanted

MANUFACTURERS' REPRESENTATIVE

calling on industrial plants and utilities

Our client, a nationally known manufacturer of electrical specialties, is expanding his sales force. If you are a top-notch sales agent, covering your area thoroughly, he may have an opening for you . . . sure to prove extremely profitable in the years to come.

If you're interested, we'd appreciate a letter from you stating full details and a list of the lines which you presently represent.

Walter J. Werbos, *Vice President*
BRIDGE RESEARCH BUREAU
Suite 500
1201 Chestnut Street
Philadelphia 7, Pa.

ENGINEERING — SALES

Are you interested in a sales engineering career in the field of instrumentation and automation? We are looking for qualified engineering graduates, preferably chemical or electrical, between 25 and 35 years of age, with a few years' experience in instrumentation or engineering sales, for location in Boston area; Buffalo; Syracuse; Greenville, S. C.; Chicago; Tulsa; Houston; and Los Angeles.

Applicants must be willing to relocate and travel adjacent territory. Car furnished, salary and expenses, fringe benefits. Sales aptitude test furnished at our expense, plus thorough training course at home office (Foxboro, Massachusetts) for successful applicants.

If you feel you are qualified for a permanent sales engineering position in this expanding industry, please write, including outline of education and experience, to

J. J. Burnett
Field Sales Manager

THE FOXBORO COMPANY
4546 Oakton St. Skokie, Illinois

Electrical Engineers Designers

BECHTEL

Offers you immediate long range engineering opportunity in

San Francisco or Los Angeles California

Engineers, designers and draftsmen required with the following experience:

Electrical Sub-Station
Hydro-Electric Power Plant
Steam Electric Generating Station

Liberal relocation allowances for you and your family

Send Resume to
Manager of Employment and Placement
Industrial Relations Division

BECHTEL CORPORATION
220 Bush Street
San Francisco 4, Calif.

For an immediate personal interview you may phone:
Paul Keating, Plaza 7-4400, New York City
Joe Braddick, Fairfax 3-2401, Houston, Texas
Bill Milligan, Tucker 1549, Los Angeles, Calif.
Don Palmer, Douglas 2-4032, San Francisco, Calif.

ELECTRICAL ENGINEER

Electrical Engineer interested in electrical design of power plants or industrial plants. Experience not required.

Excellent opportunity with consulting engineering firm in Middle West. Liberal benefit plans and good working conditions.

Send resume of education and experience with statement of salary requirements to:

P-3234, Electrical World,
520 N. Michigan Ave., Chicago 11, Ill.

• LEADING SUPPLIER OF ESSENTIAL PRODUCTS IN EXPANDING POWER TRANSMISSION FIELD OFFERS ATTRACTIVE OPENINGS IN SALES-ENGINEERING

• Men with a combination of engineering and some practical background are offered an unusual opportunity in sales-engineering with the Ohio Brass Company—a leader in the field of high voltage insulation and associated products.

• Requirements include education in either electrical or mechanical engineering, plus some experience in transmission or distribution with power companies, or the equivalent. Desirable age bracket is in the 30-35 year range.

• Work will be principally sales and customer service. The group doing this is small and congenial—you will not be buried in a large organization or department. Exceptional opportunities exist for advancement. You will be backed by the industry's finest development and research facilities.

• The company is noted for its sound management, high security, and pleasant working conditions. Residence will be in a city of 50,000 having unusually good living provisions, yet comfortably away from the pressures of a metropolitan center.

• Please give us a review of your background, as well as any personal facts which you feel would pertain to prospective employment. A general statement as to salary requirements is desired. We assure you that all correspondence will be held in strict confidence.
• *Address:*

OHIO BRASS COMPANY, Mr. W. H. Burleson, *Manager*
Power Utilities Department, Mansfield, Ohio

LIGHTING ENGINEER

A position of more than ordinary attractiveness is available to an experienced LIGHTING ENGINEER. Should have substantial background in design, selection and application of lighting for Utility Power Plants, Industrial and Office Buildings.

Must be capable of assuming complete responsibility for all technical problems related to lighting engineering.

Salary commensurate with experience.

Location: New York City

We invite you to investigate this opportunity by forwarding a complete resume to:

W. W. Patterson
EBASCO SERVICES Inc.
2 Rector Street New York 6, N. Y.

DESIGN ENGINEERS ELECTRICAL CABLE

In New Jersey—positions with large insulated wire and cable manufacturer for engineers up to 35 years old with 5 to 7 years experience. Experience in design of rubber and paper insulated cables, high voltage cables, etc. Permanent positions. Salary commensurate with experience. Write stating age, education, experience and salary desired.

Address
P-2939, Electrical World
Class. Adv. Div., P.O. Box 12, N.Y. 36, N.Y.

CAN YOU SELL POWER PLANT ENGINEERING-CONSTRUCTION SERVICE?

A major engineering firm now offers unique opportunity to the right power engineering-sales executive. Must have E. E. or M. E. degree, (power option), 10-15 years experience in thermal power plant design, economic studies and sales, intimate knowledge of private and public power industry, acquaintance with key personnel in the industry.

This man will have a managerial position of exceptional challenge, opportunity and reward. The salary is excellent and his family can live in a mild West Coast climate with year around recreational facilities and new schools. Included are free family health plan, retirement, moving allowance, other perquisites.

If interested, write in strictest confidence, stating salary required.

P-3500, Electrical World
68 Post St., San Francisco 4, Calif.

DISTRICT SALES REPRESENTATIVE

Established manufacturer for utility items. Headquarter in Chicago Regional Sales Office. Travel several states and willing to relocate if necessary. College graduate or equivalent with some industrial sales experience. Age 25 to 40, married. Salary, car, expenses. Send resume to:

RW-3512, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL ENGINEER

A position of permanent status is currently available for a graduate Electrical Engineer with steel mill background. A minimum of 8 years experience required. The position requires the ability to handle problems of electric power generation, distribution, and utilization, and prepare specifications for and recommend selection of electric equipment.

All replies will be confidential. Please reply to Personnel Manager, Koppers Company, 108 Koppers Bldg., Pittsburgh 19, Penna., by letter stating experience, salary requirements and related qualifications.

We are currently buying

GERMANIUM-RESIDUES

for the further processing of Germanium-Dioxide and Germanium-Metal.

OTAVI MINEN- und Eisenbahn-Gesellschaft
Hynspergstrasse 24,
Frankfurt/Main (Germany).

MEETINGS CALENDAR

NOVEMBER

• **Edison Electric Institute**—EEI-AGA General Accounting Committees, Henry Grady Hotel, Atlanta, Ga., Nov. 26-27; Accident Prevention Committee, Statler Hotel, Hartford, Conn., Nov. 26-28.

Inland Empire Waterways—23rd Annual Convention, Chinook Hotel, Yakima, Washington, Nov. 26-27.

American Society of Mechanical Engineers—Annual Meeting, Statler & Sheraton-McAlpin Hotels, New York City, Nov. 25-30; 22nd National Exposition of Power and Mechanical Engineering, Coliseum, New York, N. Y., Nov. 26-30.

Third International Automation Exposition—New York Trade Show Bldg., N. Y., Nov. 26-30.

Great Lakes Conferences of Railroad and Utilities Commissioners—First Annual Convention, Greenbrier Hotel, White Sulphur Springs, W. Va., Nov. 29-30.

DECEMBER

• **Electric Companies Public Information Program**—Steering Committee, Biltmore Hotel, New York City, Dec. 5.

Electrical World—Electrical Space Heating and Heat Pump Conference, Barbizon-Plaza Hotel, New York City, Dec. 5-6.

Institute of Radio Engineers—2nd Instrumentation Conference, Biltmore Hotel, Atlanta, Ga., Dec. 5-7.

Edison Electric Institute—1957 Conference Planning Committee, sponsored jointly with American Gas Association, EEI-AGA Headquarters, New York, Dec. 6-7; Street Lighting Committee, Dayton, Ohio, Dec. 6-7; Commercial Cooking & Water Heating Committee, Cleveland, Ohio, Dec. 13-14.

JANUARY, 1957

Northeastern Weed Control Conference — Sheraton-McAlpin Hotel, New York City, Jan. 10-12.

Doble Engineering Co—24th Annual Conference of Doble Clients, Sheraton-Plaza Hotel, Boston, January 14-18.

• **Edison Electric Institute**—Industrial Relations Committee, sponsored jointly by personnel section of Southeastern Electric Exchange, Sheraton Park Hotel, Washington, D. C., Jan. 17-18; Industrial Power & Heating Group, New Orleans, La., Jan. 17-18.

Southeastern Electric Exchange—Personal Administration Section Meeting, held jointly with EEI, Sheraton-Park Hotel, Washington, D. C., Jan. 17-19.

American Institute of Electrical Engineers—Winter General Meeting, Hotel Statler, New York, Jan. 21-25.

American Welding Society—Illinois Institute of Technology—3rd Annual Midwest Welding Conference, Illinois Tech Chemistry Bldg., Chicago, Ill., Jan. 30-31.

Missouri Valley Electric Association—Industrial & Commercial Sales Conference, Hotel President, Kansas City, Mo., Jan. 31-Feb. 1.

FEBRUARY

National Association of Purchasing Agents—26th Annual Mid-Winter Conference, Public Utility Buyers' Group, Brown Hotel, Louisville, Ky., February 3-5.

• **Edison Electric Institute**—Prime Movers Committee, Deschler Hilton Hotel, Columbus, Ohio, Feb. 4-6; Transmission & Distribution Committee, Netherland Plaza Hotel, Cincinnati, Ohio, Feb. 7-8; Electrical System & Equipment Committee, Somerset Hotel, Boston, Mass., Feb. 7-8.

National Electrical Week—Second Annual Observance, Feb. 10-16.

Electric Institute of Washington—Electrical Trade Conference & Exposition, Shoreham Hotel, Washington, D. C., Feb. 12-14.

American Institute of Electrical Engineers—1957 Transistor & Solid State Circuit Conference, sponsored jointly with Institute of Radio Engineers and University of Pennsylvania, University of Pennsylvania, Philadelphia, Pa., Feb. 14-15.

• **National Society of Professional Engineers**—Spring Meeting, Hotel Francis Marion, Charleston, S. C., Feb. 15-16.

13th Annual National Adequate Wiring Conference—Sherman Hotel, Chicago, Ill., Feb. 21-22.

Pacific Coast Electrical Association—Business Development Section, Sheraton-Palace Hotel, San Francisco, Calif., Feb. 28-Mar. 1.

American Society of Heating and Air-Conditioning Engineers—63rd Annual Meeting, Chicago, Ill., Feb. 25-28.

MARCH

Southern Safety Conference—John Marshall Hotel, Richmond, Va., Mar. 3-5.

Louisiana State University—Annual Conference on High-Speed Computers, Baton Rouge, La., Mar. 5-8.

• **Northwest Electric Light & Power Association**—Business Development Section, Empress Hotel, Victoria, B. C., Mar. 18-20.

• **Edison Electric Institute**—Industrial Relations Committee, EEI Headquarters, New York City, Mar. 21.

Pacific Coast Electrical Association—Engineering & Operating Section, Hotel Statler, Los Angeles, Mar. 21-22.

Oklahoma Utilities Association—Biltmore Hotel, Oklahoma City, Okla., Mar. 27-28.

Illinois Institute of Technology—19th Annual American Power Conference, Hotel Sherman, Chicago, Ill., Mar. 27-29.

• Additions this week

Power Pool Formed

The Puget Sound Utilities Council has established an operating power pool, with headquarters at Seattle.

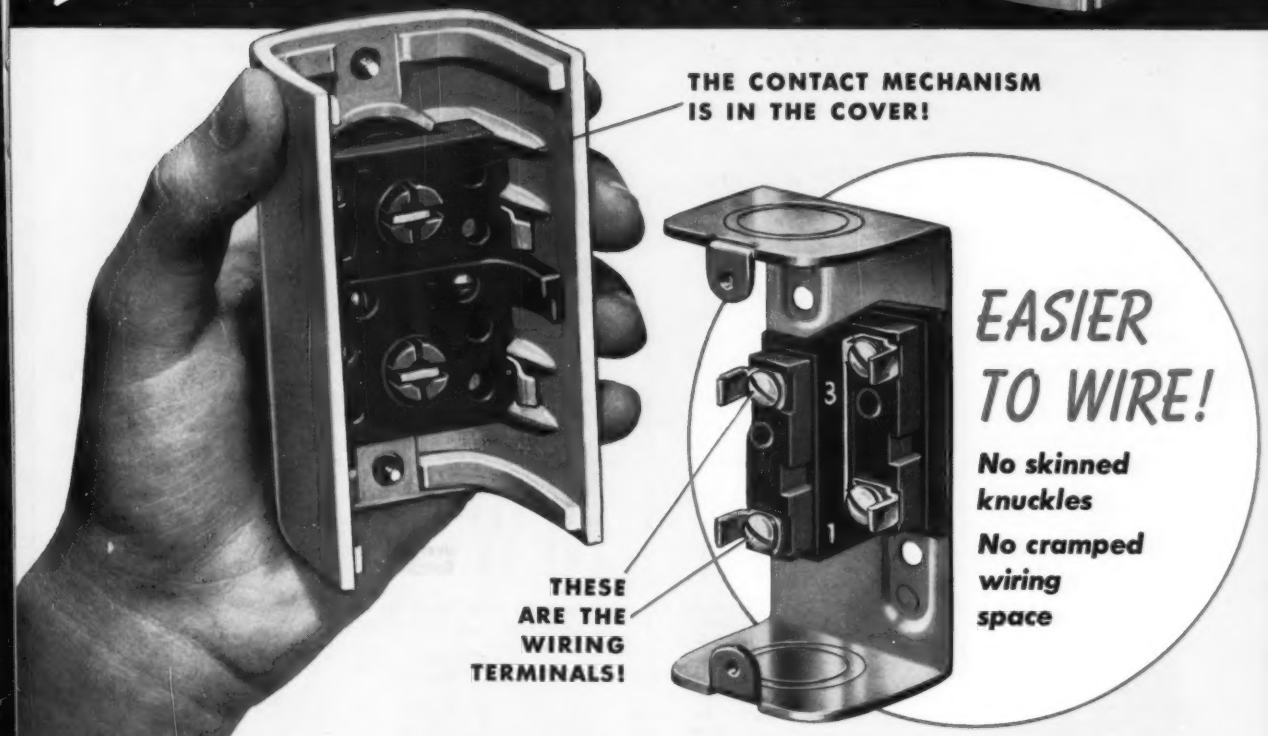
The pool presently includes Seattle and Tacoma City Light, Puget Sound Power & Light Co, and the Chelan County PUD. Snohomish County PUD, fifth member of the Council, has nothing to contribute to the pool, since it generates no power. Seattle and Tacoma for many years have exchanged power in daily operation at hours when one city had a surplus.

Richard Chang, formerly in the Portland, Ore., office of Bonneville Power Administration, has been employed as coordinator of the new pool.

Utility Buys 150-Mw Unit

To meet growing demand for electricity, Oklahoma Gas & Electric Co has ordered a 150,000-kw, $4-million turbine generator from Westinghouse Electric Corp. Scheduled for August 1958 delivery, the unit will go in operation the following year at a site not yet announced by the utility.

Brand New Idea in STANDARD-DUTY STATIONS



Here's an entirely new idea in push button stations—a wrap-around cover—with the contact mechanism part of the cover. Removing the cover exposes the terminals for instant and easy wiring. Strong, spring type, silver plated contacts connect the push button assembly in the cover with the terminals in the base.

Matching ribs in the cover and notches in the terminal blocks assure that the wiring connections are always correctly made. A bakelite shield protects the contact mechanism and prevents careless wiring from interfering with the contact operation. Concentric knockouts are provided in both top and bottom of the heavy metal base.

You will want to know about this new standard-duty station because—it is good looking—it takes less time to install—it was designed for the convenience of the installation engineer.

Let us show you a sample of this "brand new idea" in standard-duty stations!

A-B Quality

ALLEN-BRADLEY

QUALITY

MOTOR CONTROL

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ontario

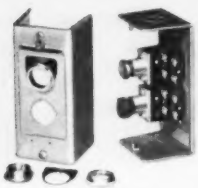
Bulletin 800 standard-duty push button stations can be supplied with one, two, or three buttons, or as a selector switch. Also available with pilot light. Furnished only in NEMA Type 1 enclosures.

9-56-MR

Also... NEW HEAVY-DUTY PUSH BUTTONS

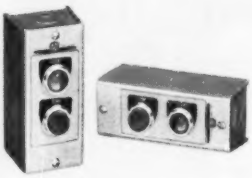
BULLETIN 800

NEW FLEXIBILITY!



You can assemble any special heavy-duty station from a small stock of standard push button, selector switch, and pilot light components. There is no need to wait for long delivery of your special stations.

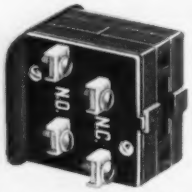
Stations can be arranged for either vertical or horizontal mounting. Name plates can be rotated to any position, replaced with any standard marking, or removed entirely.



NEW ENCLOSURES!

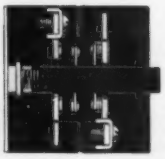
Each button, selector switch, or pilot light is a self-contained unit which can be mounted in attractive new enclosures. Standard enclosures accommodate up to eight units, but enclosures can be furnished for larger numbers.

NEW CONTACT BLOCK!



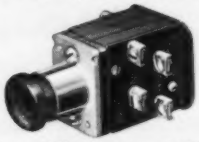
Above: View of contact block, showing terminals for normally open and normally closed contacts. Right: Contact block, with cover removed, showing stationary silver alloy contacts and pushrod carrying the moving contacts.

Bulletin 800 heavy-duty push buttons have the same molded contact blocks that have proved so dependable in Bulletin 800T oiltight push buttons, although they are not themselves oiltight. And all of them are equipped with double break, silver alloy contacts.

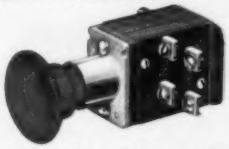


NEW OPERATORS!

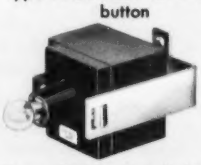
Operators, which mount on the contact block, are available in many types, and push buttons come in various colors.



Type AK2B flush head START button



Type DK6A mushroom head button



Type PK16 pilot light with transformer

Type EK11B cylinder lock unit

9-36-MR

A-B Quality

ALLEN-BRADLEY

QUALITY MOTOR CONTROL

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. In Canada—Allen-Bradley Canada Ltd., Galt, Ontario

Reactor Incident:

Property damage alone would hit millions, AEC official estimates pessimistically

What would a major reactor failure cost?

Here's the answer from W. J. Satterfield, Jr., chief of insurance section of Atomic Energy Commission:

". . . We must make certain assumptions. Let us first assume that the reactor has been operating at full power for 100 days with a corresponding buildup of fission products." He also assumes:

- Seriously contaminated land would be bought at full market price.
- Owners of land made unusable for two years would be reimbursed to about 10% of its market value.
- Crops grown on less-contaminated land would not be marketed the first year, and the owner would be reimbursed for this year only.
- As much as 1% of the fission products escape in the incident.

Having obtained Census Bureau values for urban and rural land and crops, Satterfield said, "we estimate a range of property damage for a 100,000-kw reactor from $2 million to $8 million, and for a 200,000-kw reactor from $4 million to $15 million."

Regarding personal injury, Satterfield assumed a population density of 200 to 500 persons a square mile. For the 100,000-kw reactor, one to two fatalities might result with 12 to 20 persons being exposed to damaging radiation, "even with fairly prompt evacuation." About two to four persons would be killed in the case of the 200,000-kw reactor, with radiation injury affecting 24 to 40 persons.

But Satterfield admits this estimate is entirely pessimistic:

In 12 years, AEC has safely run 25 reactors for 606,868 hr involving 17,799,000 man-hr. No accidents have contaminated nearby property or caused lost time of personnel, he said.

However there are two potential hazards in reactor operation: Reprocessing of uranium fuel after use, and storing "hot" wastes. To date, AEC has reprocessed all fuel with no incident. It currently is researching proper ways of returning radioactive wastes to nature to avoid "undesirable situations."

Colombia Starts Large Power Expansion

To keep pace with its rapidly growing industrialization, Colombia has inaugurated a vast expansion of electric power facilities to create 3-million kw by 1965. A focal point of the $600-million program is the industrial Cali area, where growing demand from large power-consuming U. S. manufacturing plants has led to construction of a 100,000-kw steam plant. Station at Anchicaya, near Cali (above) will boost capacity from 24,000-kw to 40,000-kw next year. Longer range plans call for 64,000-kw output.

Changes in Capacity Reported to FPC

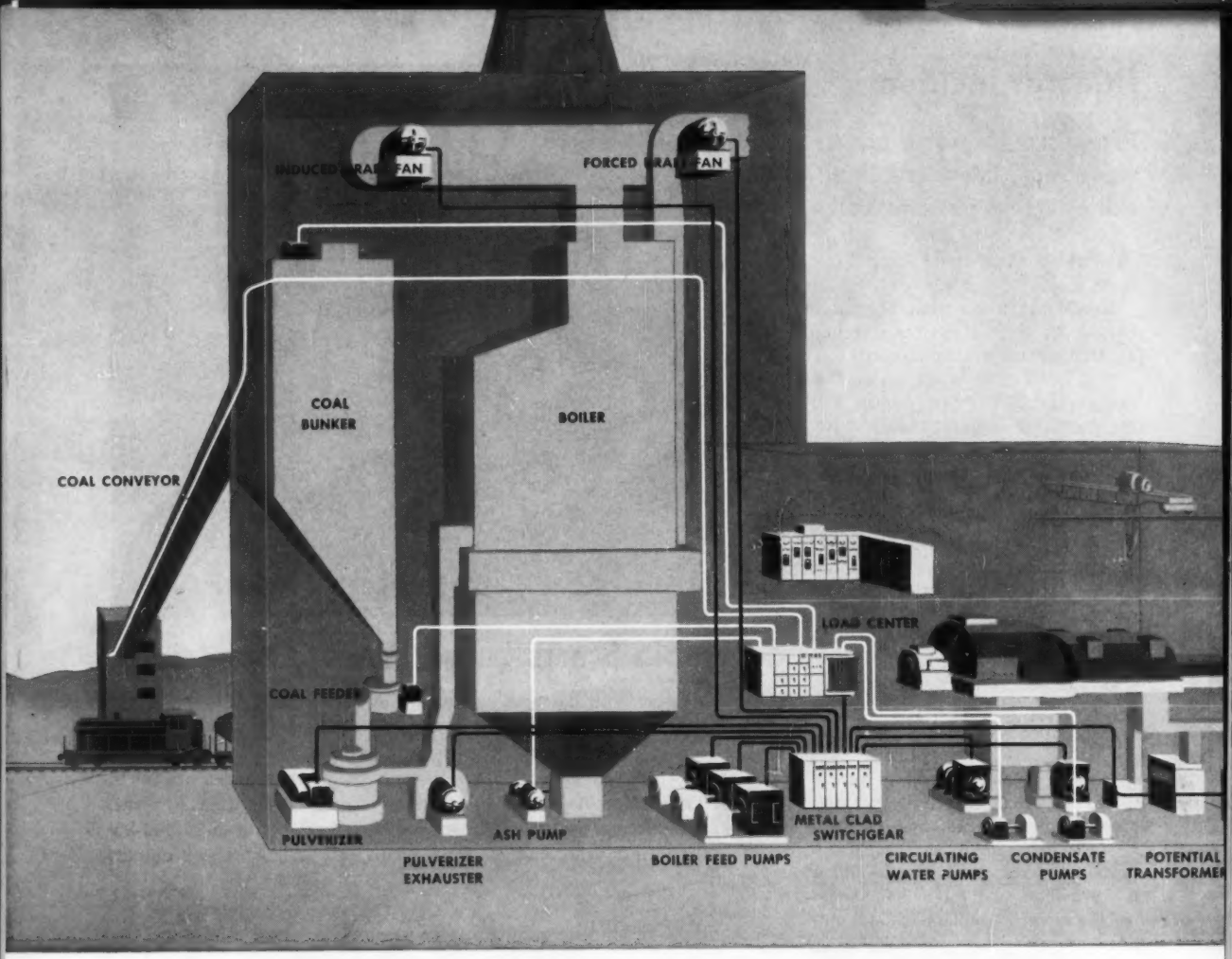
PLANT ADDITIONS DURING SEPTEMBER

State	Utility	Plant	Fuel	Capacity
Ariz.	Arizona Public Service Co.	Douglas	IC	2,500
Calif.	Pacific Gas & Electric Co.	Marro Bay	S	169,118
Calif.	Southern California Edison Co.	Alamitos	S	163,200
Fla.	St. Cloud Utilities Commission	St. Cloud	IC	1,750
Kan.	Coffeyville Municipal Water & Light Dept.	Coffeyville	S	15,000
Kan.	Neodesha Municipal Light & Power Dept.	Neodesha	IC	2,250
Mich.	Consumers Power Co.	B. C. Cobb	S	156,250
Minn.	Northern States Power Co.	High Bridge	S	100,000
Neb.	U. S. District Engineer	Gavine Point	H	33,333
Okla.	Stillwater Water & Light Dept.	Boomer Lake	S	10,000
Pa.	Grove City Municipal Light & Water Dept.	Grove City	IC	1,250
	RETIREMENTS			
Calif.	Pacific Gas & Electric Co.	Donbass	S	4,925
N. Y.	George Juengst & Sons	Croton Falls	H	590
N. Y.	Orange & Rockland Electric Co.	Tuxedo	H	250
Wyo.	Blackman & Son	Daniel	IC	25

U. S.	Hydro	Steam	IC	Total
Added	33,333	613,568	7,700	654,601
Retired	6,840	4,925	25	11,790
Adjustments Plus	.....	9,000	.....	9,000
Adjustments Minus	.....	.....	1,425	1,425
Net Change	26,493	617,643	6,250	650,386

H—Hydro, IC—Internal Combustion, S—Steam

United States Capacity as of October 1—Hydro, 25,291,412 kw; Steam, 90,980,336 kw; IC, 2,389,164 kw; Total, 118,660,912 kw.



General Electric VCI cable for station cuts installation and material costs,

In planning today's modern generating stations to meet present and future needs, utility engineers give careful consideration to the selection of cables. They know that the choice of the proper cable can effect saving in material cost, ease and economy of installation, space saving, accessibility, and greater latitude in the placement of auxiliary equipment.

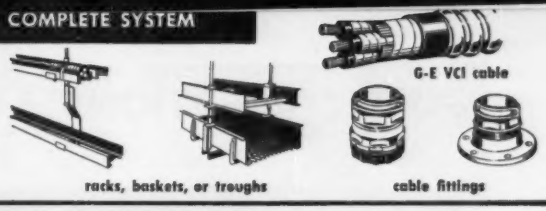
To attain these important objectives, leading electric utility companies are using General Electric varnished-cambric interlocked armor cable for station auxiliary cables. G-E VCI cuts material and installation costs, does not require conduit, and eliminates extensive engineering layout time. Because of its flexibility, G-E VCI cable provides for easy changes in location during construction or service. Its accessibility in open racks makes it easily avail-

auxiliaries provides for growth

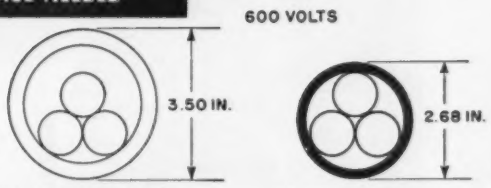
able for visual inspection or relocation.

You'll find some of G-E VCI's outstanding advantages illustrated on the right. For more specific information on how G-E VCI can cut installation and material costs in either industrial plants or generating stations, write Section W168-1127, Wire and Cable Department, General Electric Company, Bridgeport 2, Connecticut.

A COMPLETE SYSTEM



LESS SPACE NEEDED

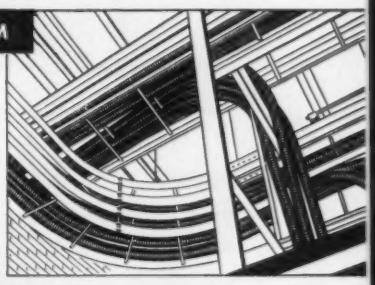


Three 500 MCM rubber cables in 3-inch conduit.

3/c 500 MCM VCI cable.

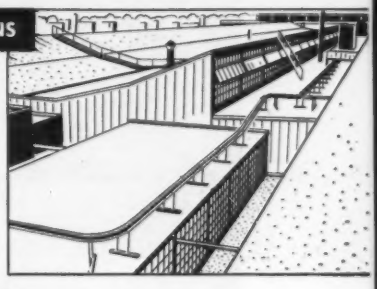
CORNERS ARE NO PROBLEM

VCI can be bent around corners and over beams without elbow fittings.

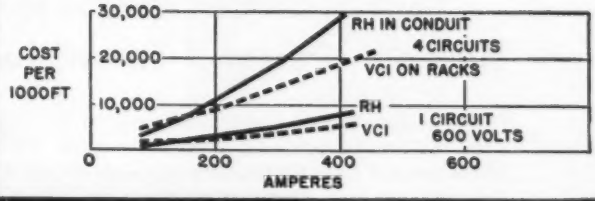


LONGER CONTINUOUS RUNS

G-E VCI can be pulled in long lengths over roofs, down shafts, across areaways without splices or joints.



LOWER MATERIAL COST

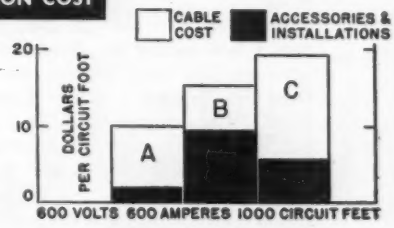


REDUCED INSTALLATION COST

A. Two 3/c 350 MCM VCI cables in parallel.

B. Two 1/c 350 MCM cables per phase, in conduit.

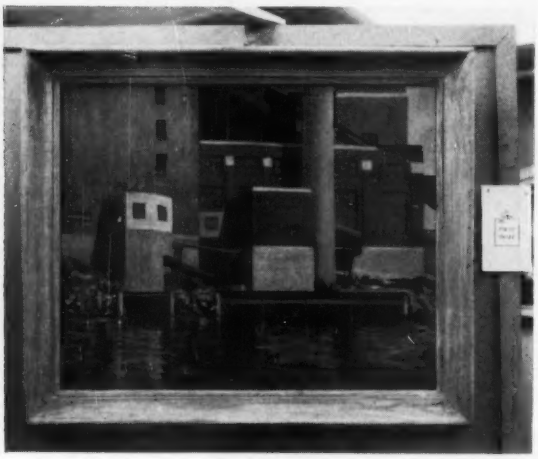
C. Bus.



Progress Is Our Most Important Product

GENERAL ELECTRIC

"COMPANY PORTRAIT" shown above in five of the 55 exhibit entries and below in Miller's prize-winning painting



New Jersey P&L "Sits For Portrait;" Show Draws 1,100 Persons

Electric utility operations may have a certain artistic beauty—or at least artistic attraction—that many of us miss in our day-to-day routine.

When the Dover (N. J.) Art Association set out earlier this year to the ambitious task of portraying the work-life in Northwest Jersey, it chose New Jersey Power & Light Co properties and workmen as its first central theme. Some twenty-eight artists in the Dover area sought to capture the utility operation in paintings, watercolor, and other media. In all, they offered 55 different "portraits" of the company at an exhibit held in late September.

The display drew more than 1,100 spectators when it was held at the Jersey P&L meeting room, and brought generally favorable comment.

Besides boosting community relations, the project also helped spotlight the little-known talents of some of the utility employees. First prize winner for an oil painting of the company's Gilbert Generating Station was Division Manager John H. Miller. Another Miller painting of a rural transmission line won second place in popular voting.

Chief Dispatcher Alfred H. Ward won an honorable mention from the official judges for a painting of crewmen at work on a transmission pole.

The company is negotiating with several of the artists and expects to buy some of the paintings for permanent hanging in its new general office building.

Here's a "Personal Touch" for Your Public Relations

One aspect of good public relations is to let people know that you are personally interested in them. Indianapolis Power & Light Co has found a way to do just that, and the response to the company's efforts has been gratifying.

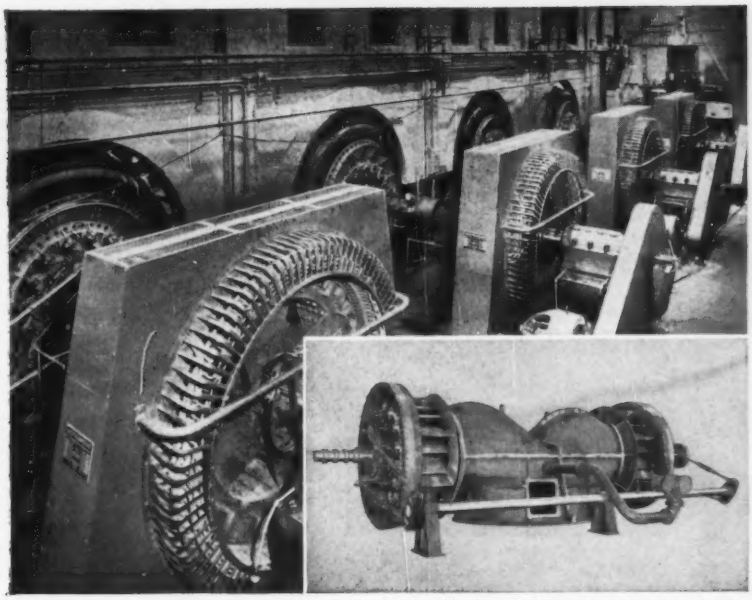
Boys and girls who get their pictures in Indianapolis papers now receive an extra clipping of the picture and accompanying story together with an appropriate letter from the company's Reddy Kilowatt. The Indianapolis project was initiated by J. D. Blythe, who assists with public relations work. Each letter says, among other things, "Thought you would like to have this extra clipping for your file . . ." In the case of some unusual accomplishment it offers congratulations. A Reddy Kilowatt pin is attached.

Letters are individually written. For example, to Katie Williams, an 11-year-old girl who competed in a diving contest last summer, wishes were extended for success in the final event. To a boy who had broken both arms, and whose picture had appeared with his arms in casts, the letter was given a humorous turn. It expressed the wish that at least one arm would hurry up and get well so he could feed himself.

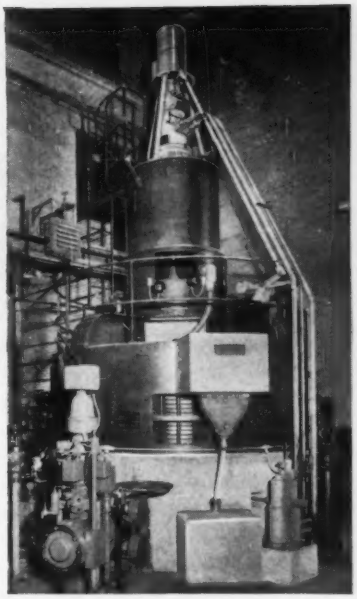
The number of letters involved has not been enough to prove a burden, numbering six to ten a day. One girl has handled the letter writing, incidental to other duties.

There has been enough response in the form of letters and telephone calls to indicate the appreciation of recipients. H. T. Pritchard, president of Indianapolis P&L is particularly fond of one letter which cites the newspaper clipping project as one of ". . . the kind of things that make home owners like to do business with your company."

The note went on to say, "Your Public Relations Department is right on the ball. . ." Other letters expressed similar appreciation.



Horizontal generating units are each driven by a pair of modernized SMS-Francis turbines shown (inset) during shop assembly.



At remote end of the power house, a vertical SMS-Kaplan unit, mounted in a concrete pressure flume provides flexibility of operation.

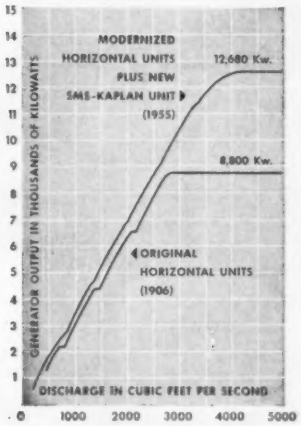
Consulting Engineers: Pioneer Service and Engineering Co., Chicago, Ill.

MINNESOTA HYDRO-PLANT WITH SMS TURBINE MODERNIZATION BOOSTS OUTPUT 35%

By completely modernizing a half-century-old horizontal turbine installation having the inside type of gate mechanism, the Upper Midwest's largest utility has raised the potential KWH output over 35%. This resulted from increased plant efficiency and greater installed capacity. The rebuilding program was a result of careful engineering studies made over several years by SMS in cooperation with the utility and their consultants with whom the purchase of modernized horizontal turbines was finally negotiated.

Four pair of horizontal SMS-Francis wheels with motor operated outside gate mechanisms were mounted on new 9-foot draft chests in the existing 14-foot diameter top supply pressure cases. An additional SMS-Kaplan turbine, rated at 3,500 HP under the 48-foot head, was added to provide flexibility and take load variations at a high efficiency over a wide operating range.

Whether your interest is modernization or a new station, you can rely on the broad engineering background of 80 years' experience available to you at SMS. For information on hydraulic turbines and accessories, write S. Morgan Smith Co., York, Penna.



Performance of modernized units based on index tests run in January 1956. Performance of original units based on guarantees when new.

S. MORGAN SMITH

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

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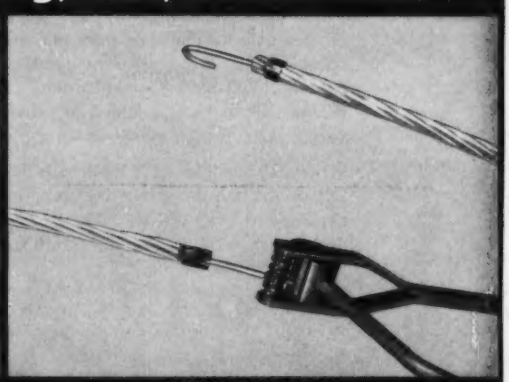
NEW!

AT LAST!
A cheap, easy, strong joining method for ACSR with single-core wire

How to make strong, fast, economical

TRIM

Try using a tubing cutter to score the aluminum strands, then snap them off. It's quicker. Or trim back conventionally.



MAKE HOOKS

Push core wire into proper size hole, close handles, and a perfect hook is made. Simplicity plus. Technique is learned in a minute.

Alcoa Hook-Forming Tool locks ACSR cores together

- **Cuts joint cost up to 42%**
- **Pays for itself in a few joints**
- **Eliminates steel sleeves**

Now, sub-transmission and distribution ACSR can be joined easily, quickly and cheaply. The Alcoa® development that makes this possible is the new hook-forming tool.

This tool forms perfect hooks in the steel core—in seconds. Cores are hooked together, clinched, and the aluminum sleeve is centered over the joint and compressed. The connection is strong—more than 95% of conductor strength—and possesses low electrical resistance.

Compared to the usual ACSR double-sleeve joint method, this new method is considerably cheaper. For example, on #4 ACSR, the hook former cuts material costs of the joint by 42%—a few joints and the tool is paid for. The need for stocking and carrying steel sleeves, and the dies for them, is eliminated.

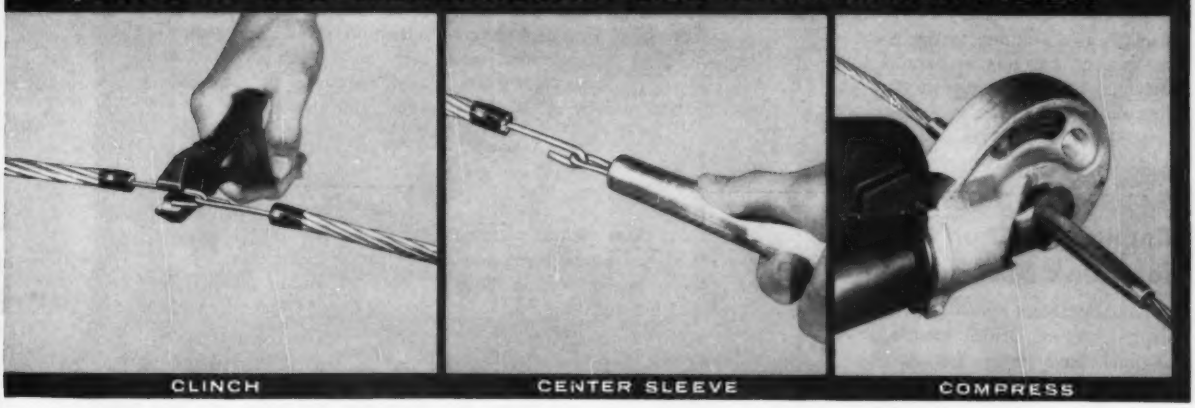
The hook-joint method saves time and annoyance, too. When the cores are hooked together and clinched, the conductor is self-supporting.

Hook joints are made in ACSR sizes #6 to 2/0, inclusive, and other conductor with similar core sizes. Tool weighs only 1½ pounds and is small enough to be carried on a belt or in a pouch, yet is ruggedly built for rough service.

Ask your Alcoa representative to demonstrate this new cost-saving tool, or write Aluminum Company of America, 2306-L Alcoa Bldg., Pittsburgh 19, Pa.

Your Guide to the Best in Aluminum Value

joints in sub-transmission and distribution ACSR



Hook cores together and clinch each hook with pliers. Conductor is then self-supporting and core wires are in exact position for compression operation.

Center the aluminum sleeve over the joint. With the hook joint, steel sleeves and their dies are eliminated.

Last step is to compress the aluminum sleeve. The Alcoa 12-A Compressor, combining 12 tons of compression in a light hand tool, is recommended.

METER DISC gets the attention of O. H. Jackson and P. J. Vinett, Central Hudson G&E; J. A. G. Oewel and F. J. Mondik Pennsylvania P&L; and M. A. Jansen, Potomac Edison, on visit of committee to Westinghouse's Newark meter plant

Relaying Combination Effective

PEA committee told of Hartford Electric Light's success with joint use of directional and phase comparison methods

Directional and phase-comparison relaying were effectively combined on a 30-mile, 115-kv transmission line of Hartford Electric Light Co, R. M. Nohes, Ebasco International Corp, reported to the Pennsylvania Electric Association's Relay Committee meeting Oct. 25-26, at Newark, N. J. Attendance of 114 set a record.

This combination, Nohes explained, provides directional-comparison relaying for phase short circuits and phase-comparison relaying for line-to-ground short circuits. The scheme was developed jointly by Niagara Mohawk Power Corp and General Electric Co as a solution to the problem of induced currents in parallel lines during phase-to-ground shorts. The line on which the relay scheme was installed was built for and originally operated at 66 kv but was re-insulated for 115 kv. Consequently it has very high induced currents.

The relaying scheme, Nohes said, is applicable "where mutual induction between parallel lines can cause false operation of directional overcurrent or directional-comparison relaying during line-to-ground short circuits and where conventional phase-comparison relaying is not sensitive enough for phase short circuits."

Combining both equipments affords reliable, high-speed protection under all circumstances, he said.

Carrier-current relaying can be applied to a 132-kv, high-pressure, oil-filled, pipe-type, underground cable, the meeting was told by H. W. Van Zee and H. G. Erdman, Public Service Electric & Gas Co. For successful operation, however, cable length should not exceed 15 miles.

Manufacturers should redesign line-tuning equipment to cut losses in such cable applications, they said, adding:

"The capacitive reactance of pipe-type cable causes voltage and current transients during faults and switching operations. Considerable further investigation is required to determine the effects of these transients on relays and their current circuits."

Audio-tone-controlled protective relaying on a 220-kv line affords continuous supervision not obtainable through a standard carrier scheme, according to A. J. Burleson, Westinghouse Electric Corp, and J. A. G. Oewel, Pennsylvania Power & Light Co. They described a PP&L installation using duplex audio tones over leased telephone wires to protect the 23-mile, 220-kv Martins Creek-Siegfried line.

Tone relaying, they said, was "the best solution as far as economics and versatility were concerned."

Noting that a switch to either carrier or microwave channels would bring no loss in investment, they said that tone relaying is more reliable than conventional pilot wire and just as reliable as power-line carrier because it is not susceptible to tripping on extraneous voltages.

A year of operation showed that tone relaying is economical for short lines when distance relays are planned as either first-line or back-up protection. On long lines telephone rental costs increase in importance. Consideration should be given it, however, as a means of relieving the carrier frequency spectrum which is often crowded.

Capital Cost Drop Foreseen for British Nuclear Plants

Considerable reductions in the capital cost of British atomic power stations have been forecast by a United Kingdom Atomic Energy Authority report. For example, stations of the future having three or four times the 92-Mw capacity of Calder Hall may cost only 10 to 15% more to build.

These figures are not likely to apply to the next three atomic stations, for which tenders are now being considered but may be achieved in those completed in 1962 and 1963-64.

The report states that further developments should lead to even better performance and lower costs for gas-cooled stations. The reductions in capital cost will automatically lead to a large decrease in the cost of electricity produced by atomic power to a level far below that of electricity produced by coal or oil-fired stations.

Oklahoma PS Expanding

New expansion planned by Public Service Co of Oklahoma includes construction of a $20-million station in the Tulsa area, with ultimate capacity of 500,000 kw; the $40-million program now underway for Tulsa power station, in which the second 175,000-kw unit is slated for May, 1957 operation; and the $7.9-million Reeves station near Albuquerque, with first 44,000-kw unit scheduled for 1959.

THEY ALL CARRY THE SAME STAMP OF QUALITY

Among the two billion dollars of plants Ebasco has engineered and constructed in the past half century are steam plants of all sizes for many of the world's foremost utility companies.

Yet there is one thing that's common to all.

Different as the plants may be in size, location, design—the stamp of Ebasco *quality* marks each one.

Ebasco has long been a leader in the development of outdoor steam stations and has pioneered many engineering advancements in utility plant construction. And Ebasco's team of experienced engineers can demonstrate that quality engineering and construction cost no more.

For a complete outline of the services Ebasco offers, write for our booklet, "The Inside Story of Outside Help." Address: Ebasco Services Incorporated, Dept. M, Two Rector Street, New York 6, New York.

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PUC's Get Atomic Power Financing Proposals

Three New York companies petition regulatory body for authority to support nuclear research on plant being built by PRDC group in Michigan

Electric companies are making their first applications to regulatory bodies for permission to finance nuclear power facilities. As has been plain for some time, the company in whose area the facility is built will bear the main burden of the fixed cost. Other participating utilities will make "research contributions."

Three New York utilities (Central Hudson Gas & Electric Corp, Long Island Lighting Co., and Rochester Gas & Electric Corp) have already petitioned the New York Public Service Commission for authority to guarantee their respective proportions of a $15-million bank loan to Power Reactor Development Co for the experimental plant now being built near Monroe, Mich.

These three companies propose to execute a guaranty agreement covering their commitments on the loan, aggregating $762,000. In addition, these companies are contributing an aggregate of $1,274,000 to the project. The other companies in the group will pick up the difference.

The PRDC plant known as the Enrico Fermi Atomic Power Plant was started on Aug. 8 with an estimated cost of $43.5 million. PRDC had received a construction permit from the Atomic Energy Commission on Aug. 4 which provided for the submission of information on the project financing and the financial resources of the PRDC group. The group was made up of 18 electric companies and six industrial equipment manufacturers. The permit also provided that its conversion to an operating license is subject to the final approval of the safety characteristics of the plant.

"Safety in operation is of primary concern to everyone interested in the project of PRDC, as with all other reactors," said Errol W. Doebler, PRDC vice president, and president of Long Island Lighting Co. "We would not contribute to this project unless we felt assured of the soundness of the basic design and construction and were satisfied that the detailed design, engineering, and testing work could be accomplished with the complete approval of the Atomic Energy Commission.

In order to raise needed capital to build the Dresden, Ill., atomic power plant of a "boiling water type", the Nuclear Power Group, Inc, was formed. Commonwealth Edison Co, the principal owner of this corporation, has paid $30 million which is included in its utility plant account. In addition, the following companies will contribute a total of $15 million to enable them to participate in research and development of the plant: American Gas & Electric Co, Commonwealth Edison Co, and Pacific Gas & Electric Co. will each contribute $2,833,333; Union Electric Co, $2 million; Illinois Power Co. and Kansas City Power & Light Co, $1.5 million each; Bechtel Corp, $1 million, and Central Illinois Light Co, $500,000.

General Electric Co, contractor and builder, is planning to spend approximately $13 million to develop fuel elements and other components as a part of its own research program in the plant.

Sen Edward Thye (R-Minn.) office has reported that AEC staff has approved a contract to build a 22,000 kw atomic plant at Elk River, Minn., by the Rural Cooperative Power Association. No financial details on the contract were disclosed. The plan proposes that the co-op would assume the capital costs amounting to $2,450,000. This includes the cost of the site. A maximum of $6,860,000 was requested from the AEC as a contribution for the development, design and building of the reactor and for post-construction research and development work. However the entire five-man AEC commission must approve the contract.

Con Ed Asked to Bid on City Plants

New York City's Mayor Robert Wagner last week sought to revive negotiations for the sale of the city's subway power stations to Consolidated Edison Co. The sale has often been discussed in the past, but Wagner had an immediate reason for his new action: The City Planning Commission has pared next year's budget request for power station modernization and improvement from $16.8 million to $6.7 million.

Wagner wrote Con Ed Pres H. C. Forbes that the city was ready to reopen negotiations. A Con Ed spokesman replied that the company would be "glad to sit down and take a fresh look at the facts and see what can be done."

City of New York already purchases power from Con Ed for one of its three subway systems, but the two remaining systems are served by three municipally-owned plants. In his letter to Forbes, Mayor Wagner noted that the city is engaged on a giant $118 million modernization program for the subway stations. Still $100 million of this money is to be spent.

In March of last year Con Ed offered the city $30 million for two of the three plants and offered to lease the third facility. However, Mayor Wagner indicated he is interested in discussing outright sale of all three plants.

REGULATION BRIEFS

A proposed state constitutional amendment to create two new memberships on the Louisiana Public Service Commission, with appointment in the hands of the governor, was rejected by the voters at the general election.

City of Lexington and 15 other Kentucky cities have filed a petition in Washington, D. C., Court of Appeals

Savannah Electric and Power Reports:

TROUBLE-FREE COMMUNICATIONS FOR FOUR YEARS WITH GENERAL ELECTRIC TWO-WAY RADIO

For the past four years, the Savannah Electric and Power Company has depended upon trouble-free G-E two-way radio to coordinate maintenance, transmission, and construction crews throughout a five-county, fifty-mile city radius.

General P. E. Seawright, Superintendent of Transmission and Distribution for Savannah Electric and Power, reports his organization has never experienced a serious break in two-way radio communications, during four years of operation. He credits General Electric's dependable equipment, teamed with a maintenance program provided by the local General Electric Authorized Service Station, for assuring his firm of full 24-hour radio services.

Radio Cuts Service Loss Time

Seventeen mobile units in the fleet of service and supervisory vehicles are coordinated by radio from the office of General Seawright, in the Savannah office.

General Seawright credits the G-E two-way radio system for speedy assists in the restoration of service in emergencies. This is a vital factor to the thousands of homes and commercial installations over 1000 miles of line.

New Progress Line Radio

General Electric's new Progress Line radio provides full chassis, interchangeability, plug-in chassis, and new 6600 series tubes, specially designed and tested for radio communication circuits.

Your Communications Counselor can give you full details. Call him in, or, write: *General Electric Co., Communication Equipment, Section X19116-26, Electronics Park, Syracuse, N. Y.* In Canada, write: *C.G.E. Electronics, 830 Lansdowne Avenue, Toronto.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

to set aside a Federal Power Commission order of June 30, 1956 in the Amere Gas Utilities case. The cities complained that the FPC order permits taxes to be "normalized" and that this in turn will result in the creation of gigantic permanent reserves.

Ohio Edison Co and Akron City Council's Public Utilities Committee are discussing a company request for an increase in the street lighting rates. City Public Utilities Commissioner William Wasick has estimated that the increase would amount to around $55,200 a year. The increase would be about 12%.

FINANCIAL BRIEFS

Pacific Gas & Electric Co and Pinole Light & Power Co have asked the California Public Utilities Commission to approve PG&E's acquisition of Pinole. PG&E would issue 7,000 common shares in exchange for 200 shares of Pinole common.

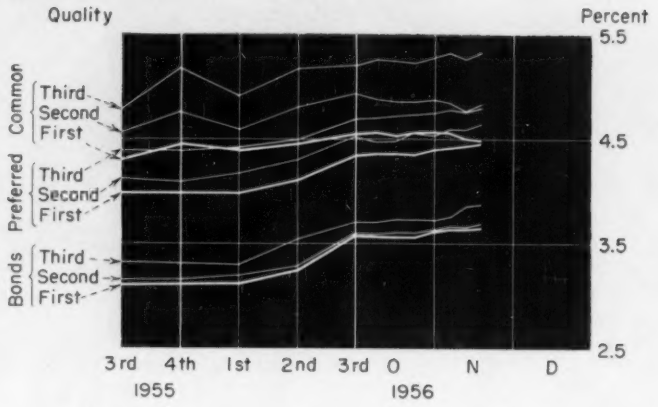
Connecticut Light & Power Co has asked the Public Service Commission for permission to combine the Union Electric Light & Power Co into the CL&P system effective Jan. 1. This was the intention of CL&P in 1953 when it acquired all of the outstanding common shares of Clinton Electric Light.

Sierra Pacific Power Co has rejected the only bid submitted for the $3 million first mortgage bonds. It was submitted by Halsey, Stuart & Co and was for 100.02% at 5⅜% interest.

El Paso Electric Co directors have approved a plan to split its common stock two-for-one, subject to stockholder's approval at a meeting to be held in March, 1957. Company will pay Dec. 15 a quarterly common stock dividend of 50¢ a share in cash against 45¢ in the previous quarter.

Northern States Power Co expects to spend $221.6 million on new construction in the five years from 1956 through 1960, Pres Allen S. King told the New York Society of Security Analysts recently. Earnings for 1956, he forecasted, should be about $1.20 a share on 14,089,328 shares. This compared with $1.16 a share on 13,418,408 shares in 1955.

Today's Utility Yields (%)



	Bonds			Preferred Stocks			Common Stocks		
Quality.....	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Nov. 15.....	3.65	3.69	3.88	4.47	4.64	4.80	4.50	4.83	5.33
Nov. 8.....	3.64	3.65	3.86	4.44	4.59	4.76	4.51	4.77	5.27
Nov. 1.....	3.64	3.65	3.75	4.42	4.58	4.78	4.54	4.85	5.32

Utility Earnings . . .

Company	Period Months Ended		Net Income 1956	Net Income 1955	Earnings Per Common Share 1956	Earnings Per Common Share 1955
Arizona Public Service.....	12	Sept.	$6,498,000	$5,145,000	$1.65(a)	$1.39(a)
Arkansas-Missouri Power.....	12	Sept.	1,795,594	1,617,148	1.95	1.57
Boston Edison.....	9	Sept.	7,238,210	7,032,117	2.59	2.59
California Electric Power.....	12	Sept.	3,473,171	2,985,122	1.00(a)	.93(a)
Columbus & Southern Ohio Electric	12	Sept.	6,592,000	6,380,000	2.16(b)	2.30(b)
California-Pacific Utilities.....	9	Sept.	536,091	497,622	1.62(f)	1.57(f)
Commonwealth Edison.....	12	Sept.	48,693,005	46,860,565	2.72(g)	2.82(g)
City of Seattle Dept of Lighting..	12	Aug.	5,605,098	5,520,988	....	....
Duquesne Light.....	12	Sept.	18,614,697	17,202,262	2.45	2.25
Electric Bond & Share,.....	9	Sept.	5,109,059	4,670,044	.97	.93
El Paso Electric.....	12	Sept.	2,504,047	2,081,236	2.61(h)	2.32(h)
General Public Utilities, consolidated.....	12	Sept.	29,262,557	25,358,398	3.02	2.61
Idaho Power.....	12	Sept.	5,675,207	4,913,746	2.14	1.82
Iowa-Illinois Gas & Electric.....	12	Sept.	5,107,985	4,811,716	2.45(i)	2.30(i)
Lake Superior District Power Co..	12	Sept.	1,182,909	1,062,302	....	....
Montana-Dakota Utilities.....	12	Sept.	3,664,722	2,835,236	1.56(j)	1.36(j)
Northwestern Public Service.....	12	Sept.	903,286	928,480	....	....
N. Y. State Electric & Gas.....	12	Sept.	11,282,723	10,524,375	2.90(N)	2.94(N)
Northern Indiana Public Service..	12	Sept.	12,546,078	11,501,282	2.86(k)	2.76(k)
Potomac Electric Power.....	12	Sept.	9,283,727	7,665,305	1.50(l)	1.28(l)
Public Service of Colorado.....	12	Sept.	10,067,533	9,193,459	2.83(m)	2.55(m)
Public Service of New Mexico...	12	Sept.	1,977,372	1,707,429	1.19	.95
Rockland Light & Power.....	9	Sept.	1,737,048	1,456,068	.84	.68
San Diego Gas & Electric.....	12	Sept.	7,011,292	5,241,063	1.52(a)	1.08(a)
South Carolina Electric & Gas...	12	Sept.	5,466,059	5,138,261	1.42(a)	1.38(a)
Southern Nevada Power.....	12	Sept.	748,612	688,693	1.39(a)	1.47(a)
Tucson Electric Light & Power....	12	Sept.	2,168,219	1,825,962	2.01	1.67
West Penn Electric, consolidated..	12	Sept.	17,861,718	17,003,287	2.11	2.01
Wisconsin Public Service.....	12	Sept.	5,312,000	5,046,000	1.78	1.67

Notes—(a) Based on average shares; (b) Based on 2,651,360 shares in 1956 and 2,401,360 shares in 1955; (f) Based on 253,978 shares in 1956 and 246,330 shares in 1955; (g) Based on 17,906,517 shares in 1956 and 16,630,622 shares in 1955; (h) Based on 896,412 shares in 1956 and 840,387 in 1955; (i) Based on 1,906,360 shares in 1956 and 1,904,396 shares in 1955; (j) Based on 1,939,827 shares in 1956 and 1,758,644 shares in 1955; (k) Based on 3,709,410 shares in 1956 and 3,602,379 shares in 1955; (l) Based on 5,910,135 shares in 1956 and 5,628,700 in 1955; (m) Based on 3,041,981 shares in 1956 and 3,036,171 shares in 1955; (N) Based on 3,337,475 in 1956 and 3,034,068 shares in 1955.

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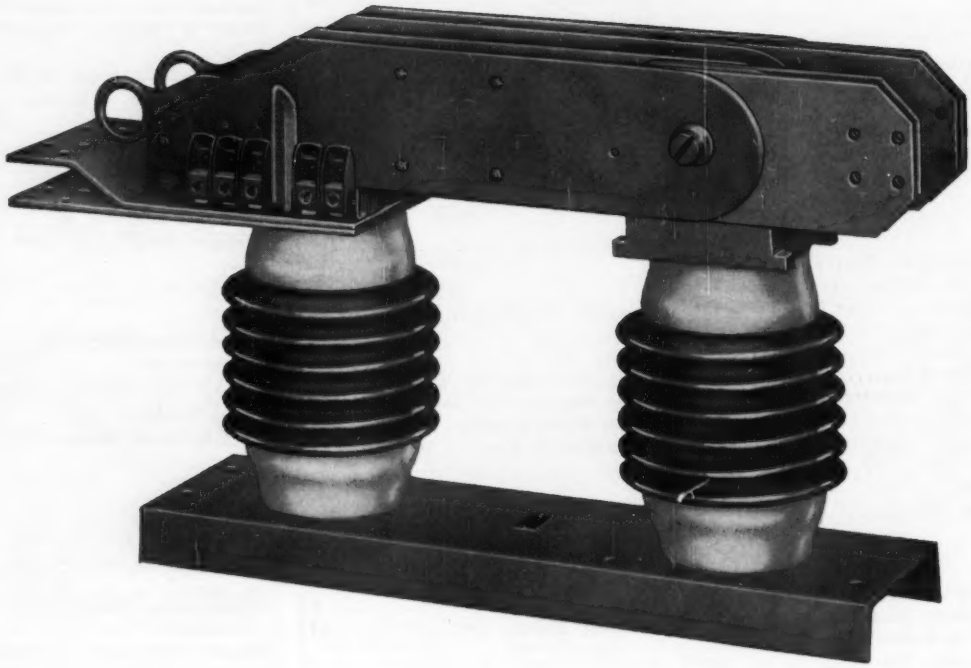

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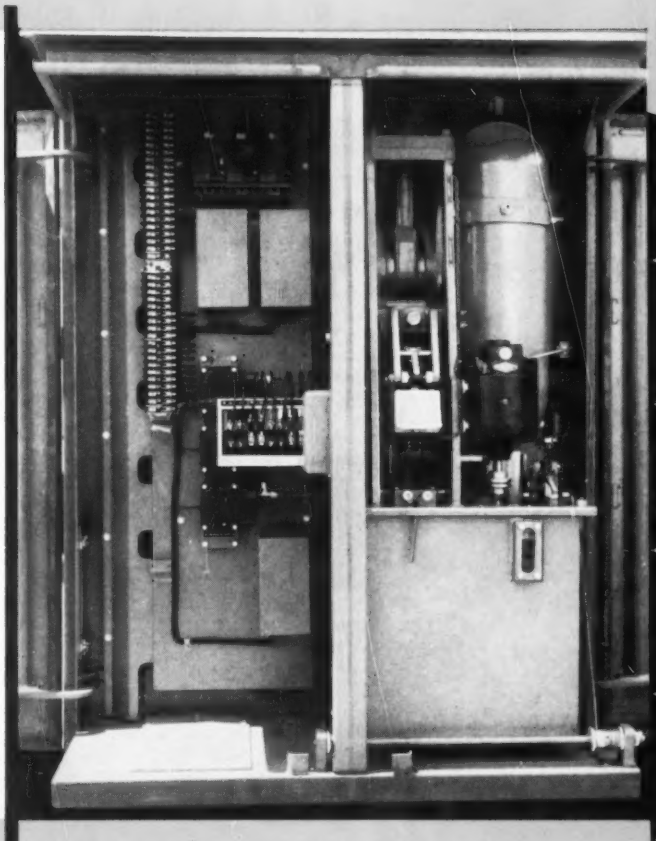

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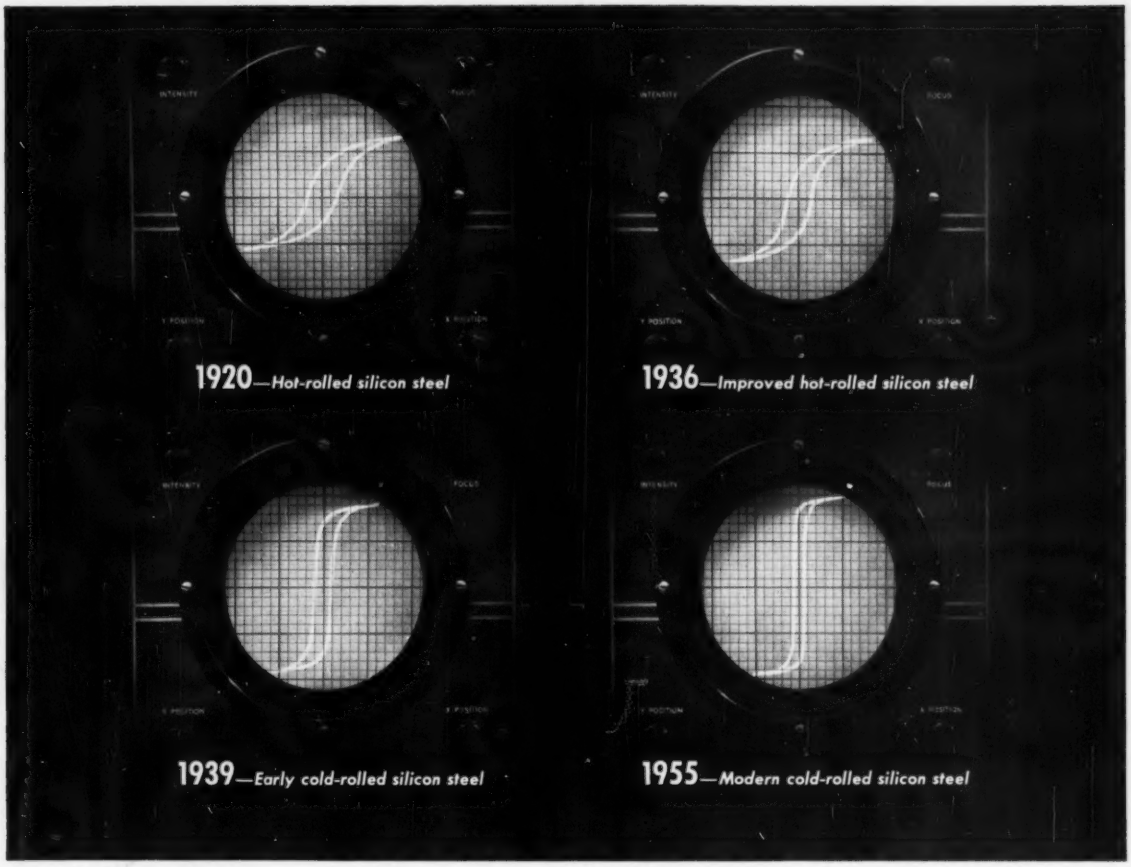

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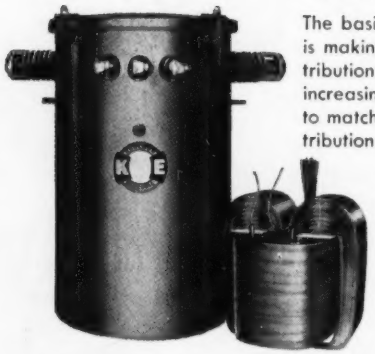

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